MUNICIPAL ENGINEERING

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TOWN SCAVENGING AND REFUSE DISPOSAL.

TYPES OF DESTRUCTORS.

By Hugh S. Watson, A. M. I. C. E., London, England.

IN dealing with various types of refuse destructors it is very difficult to generalize, since all installations must differ very considerably, owing to their having to be designed to meet the particular requirements of each case. In the case of small towns having only a limited quantity of refuse to dispose of, the destructor might consist of merely a simple refuse burning installation, while in the case of a large town where considerable quantities of good refuse have to be dealt with daily, it might comprise many accessories to facilitate both the handling and the burning of the refuse, as well as the utilization of the heat generated. The forms of destructors also vary greatly, some being constructed on the isolated grate principle, and others on that of the continuous grate, by which is meant a series of furnaces each opening from one to the other, so that the hot gases are discharged from one fire over another on their way to the outlet. The method of charging will further modify the surroundings of a plant, while even more important considerations in this respect are the site, local conditions of working, the quality and quantity of the refuse to be burned, the amount of steam that can be used, and the purposes for which it is to be employed. Bearing these considerations in mind, the author has come to the conclusion that it is impossible to take any design as being "typical" of the plant manufactured by any individual maker and he has therefore decided to confine his remarks in each case to descriptions of modern plants which have been erected by the various manufacturers under certain definite conditions.

Speaking generally, the developments which have taken place in the design of destructor installations during the past few years have been on the lines of securing better conditions for the workmen in the destructor house, and higher temperatures in the destructors themselves. More efficient means of ventilation have been introduced, rendering it possible to keep the destructor building continuously supplied with fresh air, so that the nuisance arising from dust has been considerably diminished. Various improvements in construction have also been made to insure normal ruling conditions in the furnaces. These will be dealt with in detail.

HEENAN & FROUDE'S DESTRUCTOR.

Figure No. 1 illustrates a series of six front feed cells erected at Stoke Newington by Messrs. Heenan & Froude, Ltd., of Manchester. The plant consists of two units of three grates each; each grate has an area of 25 sq. ft., and there is a separate ash pit to each grate. At the end of each unit there is a large combustion chamber placed at right angles to the furnace, and at right angles to this chamber and parallel with the furnace are placed two Babcock & Wilcox water tube boilers, each with a heating surface of 1,741 sq. ft. At the end of the boilers are the air heaters, and the gases, after leaving these, pass directly into the main flue. The material is delivered on to a tipping platform, below which are placed two hoppers capable of holding about half a day's supply. The refuse is shoveled directly from the hoppers and is spread over the furnace grate in one operation. The forced draught is supplied from two fans driven by a small motor, and the air is heated before being delivered to the furnaces. There are also a Worthington pump and an injector for filling the boilers, as also a super-heater. The fans are also used to ventilate the destructor house. This is effected by means of an air duct

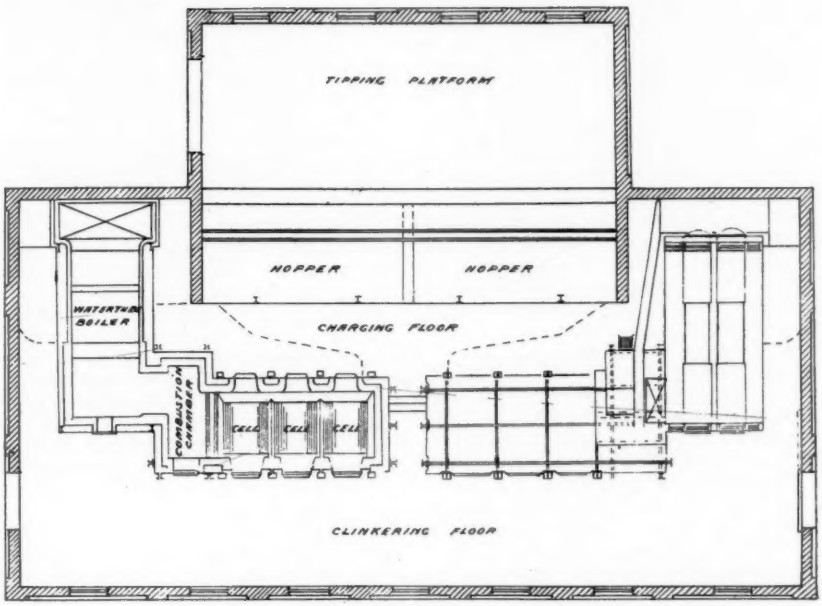
constructed in the roof, which communicates with the shaft supplying the air for forced draught for the furnaces. The air is drawn into the destructor house from all sides, and it is replaced five or six times in the hour. By this arrangement any objectionable odor which may arise when the refuse is being delivered is not distributed to the surrounding neighborhood, as is the case when the ventilation is from the inside to the outside. The cost of burning the refuse amounts to about 7.3d (15 cents) per ton, to which has to be added the cost of cleaning the flues at about 0.5d (1 cent) per ton, bringing the total cost to 7.8d (16 cents) per ton. The average quantity of refuse received at the destructor in the summer is thirty tons per day, and in winter forty-five tons per day. This is dealt with by two shifts of two men each, the number of hours worked by each shift being eight in summer and ten in winter.

MANLOVE, ALLIOT & CO.'S DESTRUCTOR.

A plant designed by Messrs. Manlove, Alliot & Co., Ltd., of Nottingham, for the metropolitan borough of Shoreditch comprises two sets of three Babcock & Wilcox water tube boilers, each having two refuse furnaces, one placed on either side of the boiler, while an ordinary coal fire grate immediately under the boiler tubes is provided as an auxiliary for use if required. A complete set thus consists of one boiler and two furnaces. As the area of the works was very limited, it was not found possible to construct an inclined roadway up which wagons loaded with refuse could be taken to be tipped directly on the top of the furnaces, and it was therefore decided to put in lifts to raise the refuse to the top platform. The refuse when received at the works is shot into one of two lifts, each provided with a tipping truck, which is run off the lift as soon as it reaches the top of the platform. The truck runs upon rails and is operated on the trolley system. The refuse is then taken into special charging trucks worked by chain gear, one of which is provided for each furnace. The average amount of refuse received per day is about 85 tons, and this is delivered between 9 a. m. and 5 p. m., but the amount varies considerably. In summer it may be as low as 60 tons, and in winter as high as 140 tons. As it is found impossible to get a supply at a regular rate, it was considered advisable to provide storage space to cope with extra large deliveries. For this purpose a large rectangular iron storage bin holding about 60 tons of refuse is fixed under the tipping platform. The lifts and tip trucks are worked entirely by electricity. Each furnace is provided with both a steam jet and a forced air blast. This is supplied by means of three Sturtevant fans, each designed to give 8,000 cubic feet of air per minute, and driven direct by a shunt-wound electric motor at a speed of 650 revolutions per minute. The inlets to the fans are connected with air ducts that draw the hot air from the top platform of the destructor. The three fans are connected to a common discharge duct which is led underground to the ash pits, the draught to each being controlled by a separate air valve. The boiler feed is furnished by a Weir pump, which forces the cold water through a Green economizer, where it is heated to a temperature varying with the load. The feed then passes into a thermal storage vessel fixed at a level of about 20 feet above the boilers. This vessel is simply a horizontal shell 30x8 feet, which is used for storing during the hours of light load, hot water with which the boilers are fed directly by gravity. Alongside the works are situated an electro-generating motor and public baths and wash houses which contain one swimming bath 100x40 feet, one swimming bath 75x34 feet, 76 slipper baths and 50 troughs for clothes washing. The exhaust steam after leaving the engines in the generating station is conveyed to the baths, where it is put through heaters which supply all the hot water necessary for the whole institution, while live steam is also supplied direct from the boilers for clothes washing. The total cost of burning the refuse amounts to 3s 8½d (90 cents) per ton, including clerks and establishment charges and cost of repairs and engineering stores. The amount of electric energy consumed in burning and handling about 25,000 tons of refuse per annum is 4.98 units per ton.

GODDARD, MASSEY & WARNER'S DESTRUCTOR.

The installation described below was constructed by Messrs. Goddard, Massey & Warner, of Nottingham, for the Tottenham Urban District Council. The plant consists of a single row of ten cells of the back-feed type, with a grate and drying hearth at an inclination of 1 in 5, each with a grate area of 40 sq. ft. Forced draught is produced by means of fans, a separate fan being



PLAN

FIG. 1

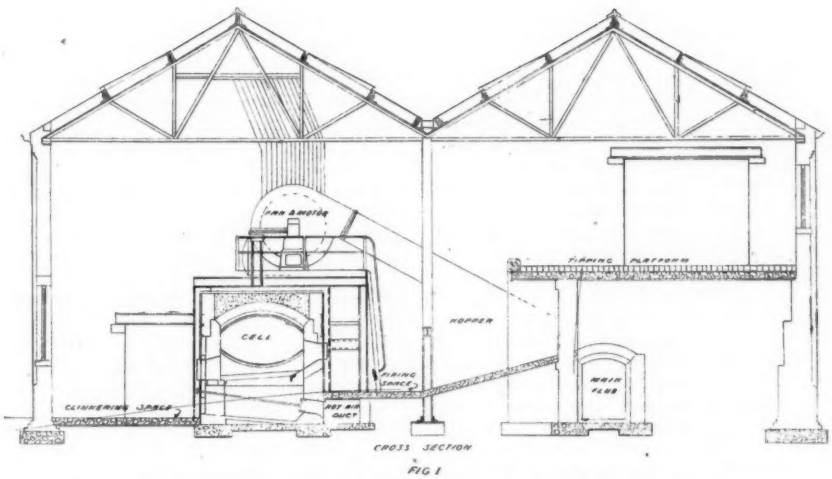


FIG 1

HEENAN & FROUDE DESTRUCTOR AT STOKE NEWINGTON, ENGLAND.

provided for each furnace. Each cell is situated between a by-pass flue and a boiler. The gases from a pair of cells can thus be passed either along the by-pass or through the boilers when steam is required to be generated. Five multi-tubular boilers are provided, each slung between a pair of cells. Each boiler is fitted with both dead weight and double lever safety valves, and can be coal fired if necessary from an independent grate. The main flue is situated immediately under the drying hearth, and runs the full length of the destructor, enlarging beyond the last cell into a combustion chamber, into which carcasses and condemned meat, infected mattresses, etc., can be placed for destruction. A dust arrester joins the combustion chamber and is formed by a series of baffle walls, which facilitate the precipitation of the dust. At this point the flue divides into two parts, one giving direct access to the shaft and the other forming a space into which is built a Green's economizer of 160 tubes. Outside the building are fixed a clinker crusher, elevator and screen. The power for driving the fans and crusher is furnished by a horizontal single-cylinder steam engine. The feed water for the boilers is obtained from the town mains and after being passed through a Lassen and Hjort softener, is forced through a feed water heater into the boilers.

THE HORSFALL DESTRUCTOR.

An automatic tub feed four-cell destructor has been designed by the Horsfall Company, Ltd., of Pershore. The carts delivering the refuse at the works discharge their contents into one of two refuse tubs. These are raised by overhead traveling machinery to the top of the destructors, and their contents dropped therein, the furnace doors opening and closing automatically only while the charge is being delivered, so that little or no dust and smoke are permitted to escape. This is a very clean feed and only requires the attendance of one man. The power for working the hoist is supplied from steam generated by the destructors, two Babcock & Wilcox water tube boilers being provided for this purpose. These are placed in the center of the furnaces, two furnaces being arranged on either side. By-passes are provided from the combustion chambers, so that the hot gases can either be transmitted to the boilers or diverted direct to the dust catcher, placed at the base of the chimney. An aero-generator is also provided in the by-pass. Forced draught is supplied from blowers worked by means of a single-cylinder engine. The ventilation of the destructor house is effected by means of an air duct connected to the blowers in the manner described in connection with the Heenan & Froude destructor.

MUNICIPAL FINANCES.

By Charles J. Crawford, Formerly Alderman at Ft. Dodge, Iowa.

A CITY OFFICIAL, along with his numerous other duties must be a financier. He must be of an extraordinary type;. since there are never any profits coming back as a result of his vast expenditures of money, and his master is critical of increase in taxes and of the results obtained. The notion may strike the taxpayer that his city financier is not as good as he ought to be, or that he has developed indications of grafting. Then there is a change of city officials, and a new crop must be educated in the science of municipal government.

The providing of funds with which to run a city is commonly as great a problem as their economical expenditure. Our laws have generally wisely limited our cities in the matter of tax levies, but in any growing city the demand for public service may often be greater than the rate of taxation allows. It then becomes necessary to provide additional revenues in other ways.

Taxation.—It is the duty of the assessor to fix the actual values and list every piece of real estate in the name of the owner, and to ascertain the taxable wealth of every individual and corporation. His completed lists are submitted to the Board of Review in the larger cities, commonly selected because of their particular knowledge of values, but in our smaller cities more commonly the city council. They must meet each day until their labors are completed, for not less than three hours work, for which the county commonly pays the munificent sum of $1.00 per day. The duties of a Board of Review are to examine and compare each item of the assessor's returns and see that property is assessed at its ac-

tual value and that all are assessed upon an equal or relative basis. That term "actual value" means that the city council should know more about values of property than the assessor, in order to fairly and equitably change his figures. Does actual value mean its forced sale value or what similar property sells at or a councilman's idea of its value? How many aldermen do you know that you would take their judgment to buy or sell property upon? However, if justice is not accorded property owners by the Board of Review they have right of appeal to our courts.

There are many serious and unsolved questions in this matter of assessment. Our railroads, telephone and telegraph companies and numerous other commercial institutions are separately assessed by the State Executive Council. These railroads are assessed upon a basis of miles of track. Upon this basis the country township gets its same share of taxes per mile as the city, notwithstanding the fact that the value of the railroad property in the city is many times that in the country township, by reason of the extensive terminals, yards, depots, roundhouses, etc. Furthermore our cities are at a constant and great expense in the matter of affording these railroad companies police and fire protection, vacating streets, paving and sewering and lighting them to facilitate the conduct of the railroad business. It is not the purpose of this argument to say that the railroads do not pay enough taxes, but merely to show that the division or apportionment of the tax paid is not equitable as between the cities and our rural districts.

The poor man with the little house and lot will pay taxes upon a valuation equal to its full value, and often these honest law-respecting men make full statements of their few hard-earned dollars saved for a rainy day. Our equalizing boards can quickly arrive at the full fair value of the little house and lot, but fail to find the hidden wealth of our "poor rich," rich in earthly possessions, poor in the sense of respect of law or honor of oath. Our corporations come nearer to paying their full proportion of taxes than do our individuals among the extreme rich and those who live on comfortable and even large salaries and yet pay not a dollar of taxes. Just how these persons evade the payment of taxes would take a book to tell. These conditions are wrong, unequal and unjust. Corporations were once favored in this way but of late years it has become more fashionable to make them pay nearer their just proportion of taxes.

The matter of assessing corporations in general, including our public service corporations, is an all important problem. Our courts are now commonly sustaining the taxing of franchises in the exceptional cases where this policy is followed by our cities.

The question of exemptions also presents a problem for serious consideration. Our state laws are often specific in exemptions to old soldiers and their widows, to churches and benevolent institutions, and even to some classes of manufacturing. In many progressive and growing smaller cities the custom of allowing exemptions from city taxes as an inducement for locating factories and other commercial institutions in a city, is very commonly in vogue. Exemptions on account of charity are very commonly seriously abused.

After the assessments have been confirmed the tax books are turned over to the county.

Upon a certain day in each year it is the duty of the city council to make a levy of taxes for the coming year. It is in the making of the levy that intimate knowledge of the city's requirements must be shown, as well as the business capacity of the city legislative body. A city should levy at no time more taxes than it actually needs. Surplus funds always lead to extravagance. In our larger cities it is required by law that estimates of the city's needs be made in advance and appropriations made out of the city's revenues to meet these estimates of expenses as allowed, and under no conditions is it lawful to exceed the expenditure of money appropriated for these various funds. In smaller cities and towns this business-like system does not generally apply, and things are run along in a slip-shod way, council meetings each week authorizing the spending of money for everything under the sun, paying little heed or attention to the city's actual needs, or income. Its warrants on its treasurer are soon outstanding in considerable amounts; the city is growing fast and its revenues are not sufficient to meet the deficit. The next step is the issue of bonds to cover this floating indebedness, which chiefly consists of expenditures for current requirements. Any policy which permits the creation of bonded debt for current expenses is a very bad one. Yet this is often necessary under ordinary methods of municipal finance.

The purpose of issuing city bonds

should be to raise funds for large or expensive improvements of permanent and lasting good to the community, such as city hall, light plant, hospital, water works, etc.

Municipal bonds are secured upon the ability of the municipality to levy taxes. The bond buyer or investor in them is assured of their security by many decisions of the Supreme Courts, which have invariably held our cities to the strict obligations of their bonds, irrespective of the purposes for which they were issued. Investors and bond buyers always look upon them with preference because they are always assured of a money return due to the city's taxing power, and the protection of a constitutional or statute limit of indebtedness.

Sinking funds are often provided to extinguish bonds, into which are paid each year specific sums. There is a question of wisdom of this practice in connection with the administration of city affairs, the accumulation of large sums of cash involving interest on deposits of city funds, yet investors more often prefer bonds which mature at some specific period, rather than the payment each year of a certain proportion of their bonds. In how many states do laws cover the keeping of these trust funds and the interest upon them, beyond providing for a city treasurer? The city treasurer of Chicago receives as a salary 25 per cent of the interest on city deposits. It is a common custom to pay a city treasurer a small per cent upon the funds he handles, which often makes the treasurer's office a fat one. In some cities it is a common evil for banks to present to city treasurers at times when balances are low large amounts of outstanding city warrants and have them made interest-bearing. Thus they not only draw interest on the warrants, but also have the use of the city's money on deposit for unwarranted periods.

Men are often successful in small business affairs and failures in large. The city's business is generally the largest in the community. Who is authority upon this problem in municipal government? Would not a state department of municipal control whose business would be to study these questions and adopt systems and methods that have been proven be of invaluable assistance to city councils? There is many a city today with a great debt, voted by the people in the support of a railroad, in some instances never built, or in some other wasteful proposition wherein the intervention of some higher authority and ability would have saved the community many thousands of dollars.

The following interesting lesson on the value of such a check on city officials was taught the author during his tenure of office as alderman. He happened to be with the mayor one morning when that official in opening his mail, found a letter from a man in Maine stating that he had purchased the day before certain bonds of the city which would mature a few years hence, and asking if there was any probability of these bonds being called or paid before maturity. It was a question that could have been answered yes or no or that the mayor did not know. But something induced us to ascertain what issue of bonds the letter referred to. We found that the administration of two years previous had refunded this series of bonds. Immediate search was instituted for the cancelled bonds, but they were no where to be found. The mayor soon got the wires hot after the firm that had bought the refunding bonds and also to the purchaser of these bonds, with the result that in about ten days the city got its cancelled bonds and a feeble explanation of how it happened. This was criminal carelessness upon the part of some city official at the time the refunding of the bonds was made. Had it been the ordinary renewal of a promissory note of any individual member of that council you may rest assured the old note would have been taken up, but city bond issues seem to have been surrounded with a mystic haze in which ordinary business methods are forgotten.

The policy of certain States permits municipalities to issue special assessment certificates in payment of all manner of public improvements of special benefit to abutting property, such as sidewalks, pavements, sewers, etc. The theory that abutting property is most directly benefited by pavements, sidewalks and sewers is without doubt correct. A common qualification in law, in paving or sewers, is that such benefits are never worth in excess of 25 per cent. of the assessed value of such property..

The question of intersections of streets and alleys is one in which varied customs prevail. Some cities pay for these intersections outright, assuming the improvement to be worth the cost of the intersection to the general public, and provide for the payment by general taxation. The intersection has, however, an important relation to each lot in the block and not

a few cities have equally divided the cost of intersection amongst the property in the blocks paved, or in all the blocks cornering on the intersections. In other instances cities have paid one-half of the cost of such intersection, distributing the other half to the property according to one or the other of the above methods.

The question of benefits in this connection is a puzzling and complex one. Take, for instance, a corner lot sixty feet frontage and 140 feet in depth paved front and side. Is it benefited the same per front foot as any inside lot in the block? The inside lot has sixty feet of pavement and the corner lot 200 feet of pavement. Street frontage is always an element of value in a corner lot, and it would for that reason be unfair to assess all property paved upon a per square foot basis, as is the custom in making special assessments for sewers. Sidewalks are more frequently built and assessed upon the frontage basis alone, but some cities take care of the intersections in the same way as they do those in street pavements, while in others the question is still unsettled and is giving trouble. To be fair to all these questions should be settled by a municipality and the adopted rule rigidly adhered to. Courts should treat with respect any well-defined policy of a city government on such questions. These are intricate questions and no rule that any court can draw will apply equitably to every piece of property in the estimate of benefits.

In sewer work the problem of special assessments involves the same intricate questions. A sewer naturally increases in size and cost from its source to its outlet. The property located nearer the outlet should not pay the cost of large pipes when smaller ones would serve his individual purpose. The equitable distribution of the assessment over the whole district benefited is the proper solution. If the whole system is not constructed at one time it is difficult in some states, if not impossible, to make such an equitable distribution. Other states, by means of distinctions between main sewers and local sewers, provide for different methods of assessing their cost and thus secure equitable distribution thereof. Even then there are occasional inequities which should have special treatment by the makers of the assessments.

The property owner, in various states, by waiving all questions of the legality and correctness of assessments, may avail himself of the privilege of paying them in five to ten yearly payments, at a nominal rate of interest. Such certificates are generally regarded as very desirable paper and find ready markets. The plan is good and often induces cities to make such public improvements. The problem for the city is to care for its proportion of these improvements, such, for example, as rebates accorded because of excesses over the twenty-five per cent. value of the property or the cost of intersections, which is no small proportion of the cost of the pavement, and if assessed upon the city might easily equal half or more of its revenue. Some states have provided means whereby a city can pledge a special tax levy spread over a specific term of years to meet such assessments. In other States the special assessments with deferred payments are not made, but estimates of the maximum cost of such improvements are made and suits are entered in court and judgments are entered against the property and forthwith collected. Contracts are then let for the improvement contemplated. These contracts are generally let for the completed work at a less figure than the estimates, and this difference is then refunded to the property owner. This has been a most unsatisfactory system, entailing all manner of municipal incompetency and trickery in recovering these rebates justly due, often tying up in the city treasurer's hands large sums of money.

Licenses.—The license problem of a city in the way of revenue is a most highly important one, producing as it does a large portion of a city's revenue. The greatest item is generally that of the saloon license, with greater innumerable and variable systems, from a per capita dog tax to a man's poll tax; licenses on public vehicles, as drays, buses, cabs and vehicles for public hire. Licenses from transient merchants and vendors should be carefully watched and rigidly enforced in justice to the resident tax-paying merchants of a city. The fines of municipal courts should not only sustain the courts, but prove a source of revenue. The public service corporation in lieu of any franchise provision for public compensation is often made amenable to this license feature of a city's authority in various ways. The collection of such licenses in our cities is very often seriously impeded by some political pull. How often do we find cities obtaining compensation from our public service corporations?

It would certainly seem that the un-

limited use of a city's streets by these corporations should be one of its greatest sources of revenue.

Municipal Accounting.—The complex nature of a city's business means a complex system of accounts, to properly care for the city's expenditures and receipts, directly embracing the offices of clerk, auditor or comptroller and treasurer. There is now well under way a general movement, the first step of which was taken by the Federal Government, to induce our states and if not prescribed by law of the states to induce our cities to adopt everywhere a uniform system of municipal accounting. This is undoubtedly the creation of the municipalities themselves, through various organizations of city officials. It is without doubt the best movement that has yet been made in the interest of greater uniformity in our cities. The State of Iowa has taken its first step in the matter of municipal control in providing an auditor, whose duties are to examine the finances of our cities and towns, require cities to make annual reports upon the uniform system recently adopted.

THE HIGHWAY SYSTEM OF LOS ANGELES COUNTY, CALIFORNIA.

By Burt A. Heinly, Los Angeles, California.

IN THE past ten years of marvelous highway construction throughout the United States, California was one of the last States of the Union to recognize the importance of the good roads movement. However, once her eyes were opened to the value of these betterments, she has undertaken to make up for lost time, and with the restless energy of the West, is seeking to accomplish in one year what other commonwealths would do in five. In this, Los Angeles county alone, with an appropriation of $3,500,000, plans for 307 miles of highways. No similar geographical division in the United States equals it either in point of expenditure or in mileage to be improved. At the present time the work now under way in this county is the largest of its kind west of the Mississippi river.

Bonds for the entire amount were voted July 30, 1908. A year later the extensive plans were commencing to materialize; today 85 miles of road are either completed or under contract, and by 1912 it is expected that the entire 307 miles will be in use by the public.

Not only the causes which led up to this determination on the part of the county to perfect its highways, but the methods which have been adopted, the rather novel course of construction and the materials used make the subject one of the most interesting in road-building history.

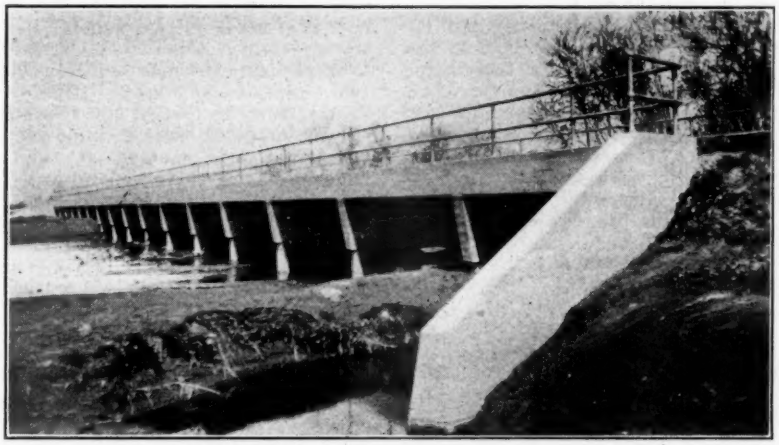
The causes were several. In the first place there has been a remarkable influx of population into Southern California in the past decade, an economic feature which of itself brought a demand for better highways. But this was intensified by the fact that where a few years ago ranches encompassed thousands of acres with little or no improvements, today they are represented by hundreds of small farms of from twenty to forty acres under highly intensive cultivation. Another cause of no less importance has been the use of the automobile. Los Angeles county is the Mecca of the motor car sales agent. Los Angeles city has more automobiles per capita than any other city in the United States, perhaps for the reason that autoing is possible every day in the year. Added to the local demand for road improvements by motor owners was that of hundreds of wealthy tourists, who bring their machines with them to the Pacific coast. These conditions gave the $3,500,000 bond issue an unusually large vote in its favor.

Early in 1907 the State Legislature passed a law creating a Los Angeles County Highway Commission. This was to consist of three members to be appointed by the County Board of Supervisors. The period of office was fixed at two years and the salary at $5.00 per diem, with traveling expenses. The membership of the first board, composed of Mr. C. D. Daggett of Pasadena, Mr. George Bixby of Long Beach and Mr. Martin C. Marsh of Los Angeles, who have succeeded themselves in office with the exception of Mr. Daggett, whose place on the board h as been taken by Mr. J. W. Calvert of Azusa.

Following its organization the new board employed as its chief engineer Mr. A. E. Loder, an engineer of ten

years' practical experience in road construction, and formerly of the United States Government Department of Roads. Mr. Loder came West with the highest recommendations in his favor. With his assistants he passed nine months in laying out a road system, so which will be offered for sale within the next few months.

With this introduction we are now ready to take up Mr. Loder's work of the past two years and some of the innovations he has introduced in road building.



REINFORCED CONCRETE BRIDGE ON LONG BEACH BOULEVARD, LOS ANGELES COUNTY, CALIFORNIA.
Across Los Angeles River, 320 Feet Long.

FINISHED BOULEVARD ON EL MONTE ROAD, LOS ANGELES COUNTY, CALIFORNIA.

that in July, 1908, when the voters went to the polls they had a very definite idea of what they were voting for. Legal delays in the sale of the bonds after they were passed made no money available until January, 1909, when $1,050,000 were sold at a good premium. These bonds bear interest at 4½ per cent., as will another issue of $1,050,000 now being prepared, and

It must be remembered that Los Angeles county still bears many traces of the old Spanish regime, and nowhere are these more in evidence than in the highways. In nearly every instance the roads have been developed from Spanish trails made before the Mexican war, which followed lines of least resistance, or mark the boundaries of Spanish grants of a century ago. It

was necessary, therefore, not only to shorten, straighten and reduce grades on old roads, but in many instances to map out and construct entirely new highways.

The system as it has been surveyed benefits 27 incorporated towns and a large number of town centers. By a glance at the accompanying map it will ge seen that these towns and villages are tied to each other and to Los Angeles by radial lines interlacing with belt lines. Here is found one advantage of the old Spanish custom of subdividing; the old land grants ran along angling lines, so that it has been possible to construct roads without regard to section lines.

The new roads connect with the highways of adjacent counties and are so laid out that one will be able to start at Santa Monica, follow a broad boulevard passing north of Los Angeles through Pasadena to the foothills, thence to Pomona and back to the ocean frontage at Long Beach; thence along the coast to San Pedro and Redondo and into Los Angeles, via Inglewood, or a total distance of 106 miles. In addition, the system provides for an air line from Los Angeles to its harbor at San Pedro, a distance of 11.5 miles, of which more will be said in the following, as the questions of freight rates and the auto truck are important of consideration.

Incorporated towns are not provided for in the appropriation, but Los Angeles now has under way a chain of boulevards which will unite with and become part and parcel of the county highway system. And in this both city and county are endeavoring to build an enduring pavement, which shall be free from mud in winter and without dust in summer, especially designed for motor travel, but of a durability to withstand the heaviest freighting.

Mr. Loder's preliminary investigations included over 1,200 miles of roads and a geological survey for road materials. In the latter the county is fortunate because excellent quarries were found and there is an abundance of heavy asphaltum oil to be had. Both of these requisite materials for road building are within a maximum distance of 35 miles from the points where they are to be used.

Three pieces of the work are being accomplished by force account, but the remaining portions are being done by contract. This latter policy will be continued unless it should be found advisable, on account of high prices, for the county to do the work itself. The aim is to apportion the contracts, each for about six miles of road or larger, up to the value of $200,000, if contractors can be found to handle them. The county furnishes the materials f. o. b. the nearest delivery point to the work.

The plan of the construction is thus: The roadway is first graded to give the easiest possible grades. On fills and in cuts it is made 40 feet wide. The maximum grade is 6 per cent., with mountain grades of 7 per cent. in one or two exceptional cases. Right-of-way varies from 50 feet to 100 feet, but in the majority of cases it is 60 feet. A California law enacted at the same time that the County Highway Commission was created provides that the maximum width of the pavement shall not exceed 16 feet. On each side of this there is placed a gravel shoulder 7 feet wide. The whole, coated with an asphaltic surface, makes a most satisfactory highway. At the super-elevation of all curves and at all angle corners special care is taken, some of the curves being "banked" as much as 18 inches on the outside. This provides for safe and comfortable riding.

The rock layer varies from 5 inches to 9 inches in depth, dependent upon the foundation, soil and the volume of traffic. Over the worst adobe an extra gravel foundation is placed under the macadam. The broken stone is used in the following four sizes:

No. 1—1½ inches to 3 inches in size.
No. 2—¾ inch to 1½ inches in size.
No. 3—¾ inch to ¼ inch in size.
No. 4—Rock dust under ¼ inch.

The stone is placed in two principal courses—a foundation course and the wearing surface. No. 1 stone is used in the foundation and rolled with a twelve-ton steam roller to within 2 inches of the finished surface. This is filled with No. 3 stone to the surface, with no excess, and this mass again rolled and sprinkled with water. It is now ready for the asphaltum treatment.

The first application of oil, which carries from 80 to 85 per cent. of asphaltum, is made in the proportion of three-fourths of a gallon to each square yard of surface and is accomplished by a special oil distributer attached to an oil tank wagon. No. 2 stone is then spread for the wearing surface to the thickness which will roll down to 1¾ inches.

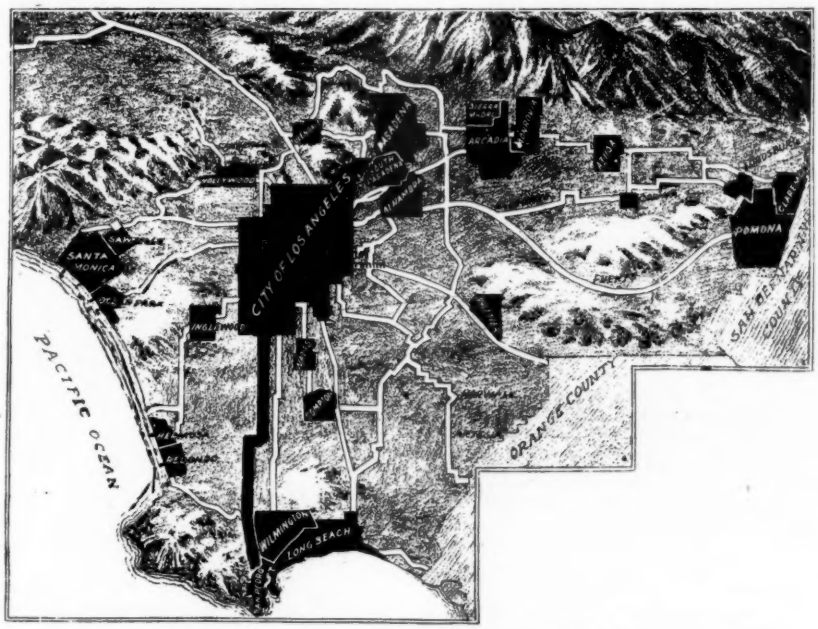
Again the mass is rolled and, while still open, a second application of the liquid asphaltum is made in the same proportion as above. No. 3 rock screenings, free from dust, are applied in a

light coat and rolled in in sufficient quantities to barely cover the 1½-inch stone. The surface is now treated with another coating of asphaltum in the proportion of one-fourth gallon per one square yard of pavement and No. 4 stone is drifted over the surface to take up any excess oil and to provide the finishing surface. Occasionally in place of rock dust a coarse, sharp sand is used in preference.

This part of the road is allowed to set for a few hot days and is then ready for traffic. It has a cross slope of ½ inch to the foot. Adjoining it on each side and with a cross slope of ¾ of an inch to the foot are the seven-foot shoulders, which have been brought to grade and rolled, harrowed for one inch, treated with asphaltum in the proportion of one gallon of oil to one square yard of surface, covered to a depth of ¾ of an inch with sand, gravel and rock screenings, then rolled.

The finished product is a substantial and thoroughly bonded roadway, ridged to carry heavy travel as well as automobiles. The sharp, angular stones have been thoroughly wedged so as to be almost impossible of displacement and the surface has been cemented with liquid asphaltum to a depth of 3½ inches, which forms a binder not to be displaced by the sheering and skidding of automobiles. Moreover, this highway is dustless, or practically so, cannot become muddy and is almost noiseless. It requires maintenance the same as a railroad as soon as it is opened to traffic, but with proper care and with average use a life ranging from 35 to 50 years is claimed for it.

In Southern California the average life of the average macadam road without maintenance and bituminous binder is placed at little more than a year. This is because of the long, hot, dry season, extending from the middle of April to the first of November. Heavy automobile travel also plays its part in road destruction.



MAP OF BOULEVARD SYSTEM OF LOS ANGELES COUNTY, CALIFORNIA.

Residence streets of Pasadena improved similarly, but not built with such perfection as the foregoing, have been in service for the past three years. They have been swept almost daily by heavy street sweepers and, without one cent expended for repairs, have a surface which today is as perfect as new asphalt, besides being much less noisy.

The method as described is being used throughout the entire 307 miles. Few figures for cost are thus far available. Conditions vary so greatly that it is almost impossible to give reliable data on the subject at this time, but the average cost of such construction, including all engineering and organiza-

tion expense, is about $11,400 per mile.

The harbor road from Los Angeles to San Pedro will probably have a solid concrete foundation, for the reason that it is planned to make of it an auto-truck highway from the docks to the wholesale district of Los Angeles. For years the city has fought the Southern Pacific Railroad Company for a reasonable freight rate to the sea and, having failed repeatedly in this, the municipality has resolved to build a highway so perfect and of such an easy grade—not to exceed 2 per cent.—that motor trucks can enter into competition with steam and iron rails. The outcome will be watched with much interest.

It is estimated that nearly 1,000,000 tons of rock will be required for macadamizing, and for this purpose the county has purchased two quarries, from which an excellent quality of rock is being taken. In each instance the rock is of volcanic origin, known as an andesite, a trap rock which stands high tests for wearing qualities, toughness and cementing properties.

The Pacoima quarry is 20 miles north of Los Angeles and here a crushing plant has been erected at a cost of $50,000. The plant, which was opened the last of March, has a capacity of 1,000 tons per day at a cost of 50 cents per ton, and when the road is completed it is estimated that the property will have a salvage value equal to the price that was paid and the improvements made. A standard gauge track has been laid for three-quarters of a mile to the main line of the Southern Pacific, so that it is possible to deliver rock from this quarry at a minimum of expense.

The other quarry, known as the San Dimas, is located 30 miles east of Los Angeles and has in sight 15,000,000 tons of volcanic andesite. It was formerly owned by an old hermit, who considered the huge rock pile useless, and he counted himself fortunate when he found a purchaser in the county for the sum of $3,000. Afterwards it was hard to convince him that he was not the robber, but the robbed. This quarry has been leased to a contractor for a period of ten years, the agreement being that the county or the Highway Commission is to be furnished crushed stone in any quantity not to exceed 1,200 tons per day at 55½ cents per ton. The county agrees to take 500,000 tons, or more, on the present work. A crushing plant is being installed and will be ready for operation by the end of May.

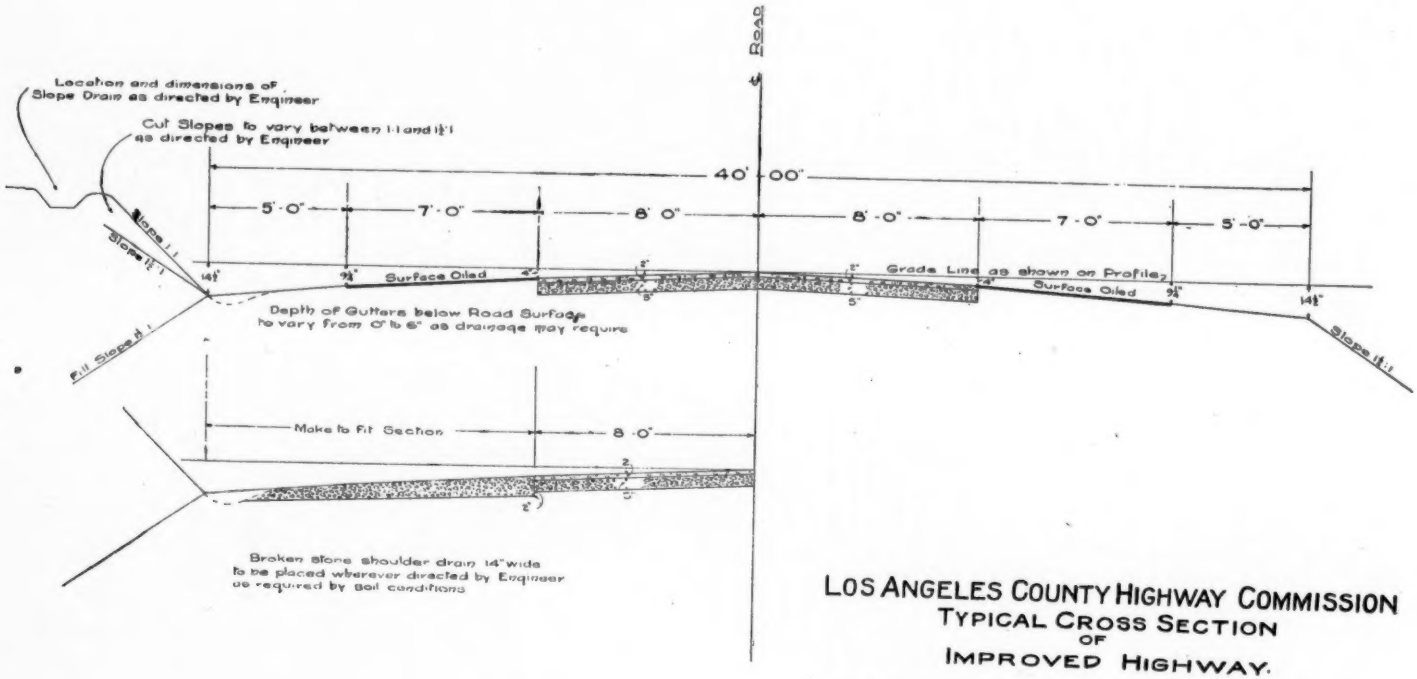
From the map it will be seen that the quarries are admirably situated at almost opposite ends of the county and on different railroad lines, so that all portions of the roads in building can be furnished with crushed stone at a low cost for transportation.

Oil is to be had from several different fields within the county limits, but the Whittier and Fullerton fields are being drawn upon principally. The oil used is a special oil residuum, which is required to contain at least 80 per cent. asphaltum. The latest bid to furnish oil was at the rate of $1.00 per barrel at the refinery, or $1.04 at the county oil pit. This oil reservoir is situated in Los Angeles, where it is accessible to two railroads and one electric line, and has a capacity of 15,000 barrels. It is built in the sand with timber bulkheads to prevent seepage, and is provided with a steam pump and heating apparatus.

The most difficult portion of the work is being accomplished in Fremont Pass, better known as the infamous Newhall Grade, 30 miles northwest of Los Angeles and the scene of many an automobile accident, where several lives have been lost. Here, to get over the summit of the low range of mountains, a defile 90 feet deep, 15 feet wide at the top and 12 feet in breadth at the bottom, was cut some years ago through the shale sandstone for a distance of 200 feet. It is approached from the south side by a circuitous road with a grade of 23 per cent., and on the north side by a 22 per cent. grade. An attempt was made to find a 6 per cent. grade over this summit, but the plan was not feasible and the county has resorted to tunneling.

The tunnel, which is to be cut through solid rock, is to be 435 feet long and will reduce the grade to 6 per cent. It is to be 20 feet wide and 18 feet in the clear. The arch section is rather unusual. There is a semi-circular arch of 10 feet radius, while the supporting walls, 7 feet in height, have an invert radius of 46 feet. The tunnel is to have a concrete lining ranging from 21 to 24 inches in thickness. In some instances the approaches, which are each a mile in length, are blasted seventy feet to grade on the high side. All the excavation is being made in rock. The contract for both the tunnel and the approaches was let in December, 1909, for $63,364 and the work is to be completed by July 15, 1910.

Another point which for years has been a source of inconvenience to traffic is the Big Tejunga wash, where the channel of the shallow stream is not dependable and of which every rain in



LOS ANGELES COUNTY HIGHWAY COMMISSION
TYPICAL CROSS SECTION OF IMPROVED HIGHWAY.

Scale — 0 1 2 3 4 5 — Feet

A E Loder-Chief Engineer

the mountains makes a passage attended with difficulty and some danger.

Most California rivers flow upside down, that is, the subterranean flow under normal conditions is as large as, or in many instances exceeds, the surface flow. The Big Tejunga is no exception to this rule. It is not bridged and farmers with teams reap a rich harvest during the winter season from the unfortunate automobilists who become caught in the sands. To make a passage of this ill-favored place both safe and easy the wash is to be spanned by four bridges, practically temporary because of the changing and rising channels. These bridges will have an aggregate length of 1,216 feet. The abutments are to be concreted, the piles of reinforced concrete and the decks of timber with asphalt paving. The piles will be set in place for the reason that the boulder wash prevents driving or jetting. One of these structures has just been completed, as shown in the illustration. The remaining three are yet to be built, but will be in place in time for next year's flood season.

Another structure of much interest is the bridge on the boulevard which connects Los Angeles with Long Beach. This bridge spans the Los Angeles river and is a simple structure 320 feet in length. It is of reinforced concrete with 19-foot spans, carried by floor beams on 26-foot concrete piles jetted and driven. The flooring consists of concrete slabs 13 inches in thickness. The cost was $12,000. One of the accompanying photographs shows it.

In all bridges the most permanent and highest class of construction is employed, with the exception of those across the Tejunga, and these are made semi-temporary by the conditions which they are built to surmount. Reinforced concrete is used in nearly every instance, as in the case of culverts, excepting in some instances where corrugated metal of a non-corrosive iron is employed.

In the construction of the Long Beach Boulevard, which is an entirely new road over a new right-of-way, and built in an airline, it was necessary to make a cut of 500 feet in length through a hill of very sandy soil. The excavation is 100 feet wide at the top and is 22 feet deep, while the sides have a slope of 1½ to 1. To prevent wind and rain erosion, a rather novel scheme was adopted. The slopes have been covered to a depth of 4 inches with barn manure and this is held in place by wire chicken fencing with a two-inch mesh, staked 3 feet by 3 feet. The whole is to be planted with morning glories, misembry antheum or other similar vegetation. The cost did not exceed $500. In this, as in most of the grading that is being done, the work is accomplished with steam plows and elevating graders.

Owing to the very large amount of road and street improvements in progress within Los Angeles and other incorporated towns independent of the county construction, there is a dearth of contractors equipped with the proper machinery and who are able to bid on the contracts. The Highway Commission is especially anxious to interest contractors from a distance who are prepared to do the work on a large scale, and an excellent opportunity is offered to individuals or companies capable of handling large contracts.

At the present time the organization is in a position to carry on construction with great facility because of the opening of the stone quarries and the completion of the crushing plants. Five miles of roads have been completed, 75 miles are under construction, advertisements to construct another 60 miles have been published and the engineering department is rapidly preparing specifications for the remainder.

Ranging in size from $50,000 to as high as contractors can be prevailed upon to undertake the work, the magnitude of each contract makes it possible to place an engineering superintendent on each job and the construction is watched with the same closeness as if it were under force account. To this supervision is added that of a cost-keeping department, lately organized, which itemizes all work and all materials entering into it.

The time estimate for the completion of the whole road system will be determined by the rapidity with which crushed rock can be procured. Now that this problem seems to have been solved, it is expected that 1912 will see the entire 307 miles open to traffic.

In closing, a word must be said about the street and boulevard system of the city of Los Angeles, in many respects as remarkable as that which the county is installing. In 1904 Los Angeles, for a city of its size, had the worst streets of any city in the country. A year later there began a remarkable reformation, due largely to the vigorous campaign which was waged by the Municipal League. Today all of the leading thoroughfares have been paved with asphalt. These will connect with the county boulevards, and in four instances where bridges are required, the

municipality is rearing stately structures at a cost of $1,000,000.

The whole city and county system, when completed, will give to Los Angeles county a network of broad and enduring roads, making every section of the territory readily accessible and offering scenic attractiveness ranging from long stretches of level beach to mountain heights, which it will be difficult anywhere to surpass.

STERILIZATION OF WATER.*

By Walden and Powell, Baltimore County Water and Electric Co., Baltimore, Md.

THE sterilization of public water supplies has been the subject of careful investigation by many municipal and private corporations for the last two or three years, and more so in the past year, owing to the shortage of water and the fact that many supplies, including wells, reservoirs and small streams became badly polluted due to wash when there were rains and at other times when there was not sufficient water to properly flush the streams or surface to prevent pollution from such wells through the sand strata. These investigations have invariably met with the obstacle which has been the stumbling block in all such enterprises, that is, first cost and operating cost of the purification system.

The Baltimore County Water and Electric Company have been operating a filter plant for a number of years and being desirous of obtaining a cheaper method of sterilization, have from time to time been investigating the various methods of filtration, namely, slow sand, American or rapid sand, and the up-draught system of sand filtration here, as well as the European. This company has also experimented for several years with the application of alum and hypochlorite of lime applied directly in the reservoirs or storage basins themselves, with considerable success, as will be shown in this paper.

In addition to the above-mentioned careful investigations, the sterilization of water by ozone was considered about two years ago. The United Water Improvement Company controlling the James H. Bridge patents, submitted a sample 3,000-gallon ozone sterilization plant for test, which was placed alongside the American or rapid, and slow sand filters, handling raw water directly without sedimentation. Some of the results obtained from this sample plant have already been reported in a paper on the use of hypochlorite of lime, which has also been in use both in the American and English filters for some two years. In addition to these tests, a rough determination of the amount of nascent oxygen in a grain of chloride of lime has been made, and the approximate calculation of the volume of gas on a basis of .1 grain per gallon, to get an approximation for the volume of ozone, which was roughly .00096 cubic inch per gallon, but this depends upon the concentration and will vary with the condition of operation and temperance. The specific gravity of ozone throughout the test has been taken at 1.65, as compared with air as 1.

With the data at hand, the ozone plant at Lindsay, which had just been started, was investigated, and it was decided to install a sterilization plant at the Herring Run Station of the Baltimore County Water and Electric Company, to have an ultimate capacity of 10,000,000 gallons in 24 hours with roughing filters to remove the suspended matter, to handle the raw water at double or triple the usual rates per unit area in rapid or American sand filters. Plans were gotten out and work started, but considerable difficulty was met with owing to quicksands. The sterilization pit was thirty feet deep and within twenty-five feet of the river bank. The walls were not completed until it was late in the fall. Work had to be abandoned during the winter other than to test the many different kinds of mixing head or aspirators, including various nozzles, converging tubes, orifices, etc.

As it was important to get information as to the amount of air that could be mixed with a given volume of water under our low head, it was found that under low heads some aspirators would not give a continuous draught of ozone or air, and when the draught was heavy the specific gravity of the mixture would become so light that there

*From a paper before the American Water Works Association.

would be a blow-back, which would momentarily blow the ozone input back, and while it was possible with low heads to get about one-third ozone to water in volume, the lowest point or head that should be considered is about twelve feet. Though some changes which were made in the design of this plant and adopted at Ann Arbor, Mich., will allow the use of heads of from six to ten feet, same will not give a steady input of ozone, as it is intermittent. This, together with the use of a small blower, seems so far to be satisfactory.

The area required for plant of size installed is only about one-tenth that required for American plant, and is not to be compared with the area required for slow sand filters. The sterilization plant proper constitutes raw water chamber, aspirator heads, ozone chambers, ozone generator, as well as time contact basin or mixing cell. The latter compels the water to travel horizontally as well as vertically, so as to give water the benefit of as long contact as is possible with ozone.

The ozone generator consists of boiler plate, shell and head, containing each 109 two-inch aluminum tubes, inside of which are micanite tubes or dielectrics, inside of which is another tube or cylinder which rests on a tray, which is connected to one terminal of a special 10,000 to 15,000 volt static transformer. The other terminal, which is a ground terminal, is connected to boiler plate shell; inner and outer tubes being so close and only separated by micanite tube, allows a continuous violet discharge to take place through the dielectrics, and the passage of air through this discharge produces the ozone, the production running from eighty to one hundred grammes per k. w., and the concentration of five or less, depending upon the condition, velocity and the temperature of the air discharged.

Sparks must be prohibited, as when a sparking condition takes place nitrous oxide is generated, and also high temperature should be provided against in the generators.

There is under construction another type of ozone generator, which from test on a small experimental unit has given as high as sixty grammes of ozone, with concentration of twenty, but it is too soon to say how this will work out in much larger sizes. This company expects, however, to have one of these generators in use soon for test, and more definite results will be obtained. The ozone generator may be either water, oil or air cooled. If it is air cooled, the outer shell has to be removed and the top and bottom heads supported by four rods, or a frame used, and air caused to circulate by any means between and around the outside of the fixed tubes.

The ozone generator in use here will be cooled by oil, to prevent, if possible, the sweating of the tubes when water is the cooling medium, as the oil will remain for some time after current is cut off, preventing moisture collecting and giving trouble at starting. The only trouble to be feared with oil cooled system is leakage, owing to the fact that it is a hard matter to get joints that will stay tight under oil pressure, although the pressure will not exceed from two to three pounds under any condition. Oil is circulated by means of ½ h.p. motor belted to rotary pump, the oil being passed through copper coils in a tank or cylinder through which water is flowing continuously. Each generator has its thermometer for determining the temperatures, and a controlling panel on which will be mounted indicating wattmeter, potential transformer plug, high tension switch, voltage regulating head which will permit of handling 2,300 volt current on the primary side of the transformer in such a manner as will give voltage of the secondary side of the transformer range from 7,500 volts to 15,000, or to be varied to intermediate volts. In addition to this there is a voltmeter reading to 15,000 volts, power factor meter, and frequency indicator. These panels are located over a concrete vault in which are located the transformers. Each million gallon unit requires 5 k.w. in transformer capacity. All the switching is done at 2,000 volts on the primary side, and the high tension side is connected directly to the ozone generator through varnished cambric lead-incased cable two-conductor, placed in bituminized fiber tubes, encased in concrete.

Owing to the weather conditions and the fact that some of the apparatus for this plant, such as insulators, etc., were special, and the departure from the original design, continuous tests have only just begun on this plant.

Considerable information was obtained, on some of which further experiments will be carried out, to determine what would appear to be the slip of the bubbles of ozone or air, and the fact that they do not seem to fall at the same velocity with the water, or for some reason do not receive or hold the kinetic energy imparted to them, and the fact that the

bubbles seem to rise at about .75 of a foot per second, this together with the fact that the specific gravity of the air bubbles and water, when the amount of ozone or air reaches certain entrainment, is so low that it loses its kinetic energy and the blow-off is caused, previously mentioned, and is similar to the action of the air lift, the mixture looking like soap bubbles in the down pipes momentarily.

When the temperature of the atmosphere is at or below zero, the strength of the ozone seems to be greater, and the absorption by the water varies, as the strength of the ozone given off by the water in the relief chamber over the time contact basin or pit is noticeably less to the smell, and a longer or shorter time is required in high temperatures or extremely cold weather before the ozone is noticeable. But the ozone in this relief chamber becomes noticeably thin when the temperature is high, but varies. Bunsen and Carius found that one hundred volumes of water near freezing absorb four volumes of oxygen and two volumes of nitrogen; and the absorption is quickened by stirring or mixing. Tests are under way to ascertain more fully this relation to the absorption of ozone as water absorbs more air, and the more of it the lower the temperature; also it absorbs more oxygen than nitrogen. It is to determine this relation when ozone is mixed with water, as no data are available at the present time, that experiments are being made. From this, it seems that these gases, when absorbed, are given up as pressure lessens, that is, given up in minute bubbles, similarly to water which is highly charged with air and allowed to stand in a glass, which gradually becomes clear at atmospheric pressure. A cubic foot of water holds in solution about 0.029 cubic foot of air at about freezing point, and it is possible that the absorption or change increases or decreases the CO_2 in the water when ozone is applied.

The generators require about eighteen watts per square foot surface in the electrodes at sixty cycles, and twenty-one watts per square foot at one hundred cycles, but it is hoped to materially reduce the wattage with the new form of generators.

The tests below, which have been carried on under Mr. Powell's supervision, will undoubtedly prove very interesting.

OZONE RESULTS.

DATE	Bacteria		Coli		Color		Turbidity	
	Raw	Ozone	Raw	Ozone	Raw	Ozone	Raw	Ozone
December 10-09	1840	6	2/4	0/4	20	15	15	15
11-09	1800	8	4/4	0/4	20	14	16	14
13-09	15000	80	4/4	0/4	45	12	180	180
14-09	4000	1620	3/3	1/4	35	28	80	80
14-09	4000	1410	2/4	0/4	34	30	80	80
15-09	1950	22	1/4	0/4	16	11	20	20
16-09	1500	960	1/4	0/4	16	10	18	18
17-09	1120	870	1/4	0/4	16	12	18	18
18-09	1960	1500	2/4	0/4	17	12	20	20

14th, 16th, 17th and 18th shows the effect of moisture on the tubes.

The company's filtration plant at Avalon, Md., which has already been mentioned, consists of slow sand and mechanical filters, and an experimental ozone apparatus. Since the construction of the rapid filters, about two years ago, hypochlorite of calcium has been used for sterilizing the water in connection with filtration at this plant. The hypochlorite has not been used continuously, as at times the raw water contains but a few hundred bacteria per cubic centimeter. The object in using the bleach has not been necessary because of the failure of either system of filtration, but to lessen the cost of operation and at the same time to deliver water which was practically sterile.

Experiments also were carried on in the laboratory for a better knowledge of the action of the bleach upon the raw water, and to determine the bacterial efficiency under abnormal conditions.

The hypochlorite of lime used was received in 750 sheet iron drums. Only a small opening was cut in the drum so that it could be tightly sealed to prevent rapid deterioration of the chemical. Average analyses of the bleaching powder contained 34.2 per

cent. of available chlorine. A 0.5 per cent. solution was used and was applied to the water through a graduated orifice. The storage solution tanks are of reinforced concrete and have a capacity of 41.5 gallons. The solution flows from the storage tanks to the orifice boxes which also are made of reinforced concrete. The head of solution upon the orifice is kept constant by a value controlled by a ball float. The tanks and boxes before being used were painted on the inside with elaterite paint, so there has been no trouble from leaking. The orifices were graduated at the plant and have been checked from time to time as to their accuracy.

In making up the solution, the required amount of bleaching powder is first dissolved in a small quantity of water to insure thorough breaking up of all lumps. This solution is then put in the storage tank and the required quantity of water run in.

Under ordinary conditions the capacity of each tank is sufficient for four or five hours' supply. By making up the solution so often, the hypochlorite does not lose its strength to any appreciable degree, and it is not necessary to change the setting of the orifice unless there is a change in the character of the raw water.

The table given here shows the amount of bleach in grains per gallon applied to the water at different settings of the orfice. It will be noted that the chemical is given in grains per gallon and not as parts per million of available chlorine or oxygen. The only object in doing this is that grains per gallon is more easily understood by the filter operators than the other terms mentioned.

There was an apparent increase in the bacterial reductions from the bleach when used in connection with sulphate of alumina, over the reduction obtained when bleach only was used. Experiments were undertaken in the laboratory to determine if this condition existed. Tests were made upon the raw water with conditions as near those at the filtration plant as was possible to obtain. One set of samples was treated with various amounts of bleach from 0.05 to 0.5 grains per gallon of water. To another set of samples were applied the same amounts of bleach, but to each jar of water was added sulphate of alumina at the rate of 0.5 grain per gallon. Several of these tests were made during the year and the curves given here were platted from an average of these tests.

Although there was not a great difference in these results, still it is interesting to note that the curve platted from the results when alum and bleach were used runs uniformly below the curve when bleach only was used. With highly polluted water this condition would no doubt be more pronounced than it has been here.

The color of the raw water at Avalon ranges from 5 to 65 parts per million, most of which is not in true solution, but in a collodial state. The water is more highly colored during spring and fall floods than at other times of the year. The effluent from the mechanical filters is colorless at all times, also the effluent from the slow-sand beds, when the color of the applied water is below 20 parts per million. When the color of the raw water is greater than this, there is always some color in the filtered water from these beds.

By the use of hypochlorite of lime it has been possible to reduce this organic stain from 5 to 15 per cent., the

TABLE TO BE USED IN THE APPLICATION OF HYPOCHLORITE OF LIME.

Capacity of storage tank, 41.55 gallons.
Charge of bleach, 2 pounds.
Orifice graduated in inches.
Rate of filtration, 1,025,000 gallons per 24 hours.

Graduation on Orifice Scale	Drop of Solution in Tank in Inches per Hour	Grains of Hypochlorite of Lime Delivered per Hour	Hypochlorite of Lime	
			Grains per Gallon of Water Filtered, One Filter in Operation	Grains per Gallon of Water Filtered, Two Filters in Operation
1	1 in.	583	.026	.013
2	2 in.	1166	.032	.026
3	3 in.	1749	.078	.039
4	4 in.	2332	.104	.052
5	5 in.	2915	.130	.065
6	6 in.	3498	.156	.078
7	7 in.	4081	.182	.091
8	8 in.	4664	.208	.104
9	9 in.	5247	.234	.117
10	10 in.	5830	.260	.130

percentage reduction depending on the character of the color, the amount present, and the quantity of bleach used.

An attempt was also made to determine the effect of hypochlorite upon organic matter as measured by the required oxygen. These experiments, as those upon color, were done at the laboratory and consisted of treating liter samples of raw water with bleach varying from 0.05 to 0.5 of a grain per gallon and determining the organic matter before and after treatment.

From the data at hand, the reduction of organic matter by the use of hypochlorite was hardly noticeable even with water high in organic matter, and when comparatively large quantities of the chemical were used.

To determine the efficiency of the bleach on the operation of the mechanical filters, a two months' test was run. The filters were operated during the month of November, using only alum. During December, from the fourth to the end of the month, hypochlorite of lime was applied with the coagulant. There was but little change in the character of the raw water during this period, so the results can be compared fairly well. By the use of a very small amount of the hypochlorite (averaging 0.087 grains per gallons) it was possible to reduce the alum from 0.87 to 0.58 of a grain per gallon.

The percentage of water used in washing the filters was reduced from 4.1 per cent. to 2.9 per cent., at the same time increasing the length of time between changing the filters one hour and ten minutes. This reduction in coagulant of 0.22 of a grain per gallon amounts to 31 pounds per million gallons; with the cost of alum at $1\frac{5}{16}$ cents per pound f.o.b. Alavon, the saving was 41 cents per million. Deducting from this amount 11 cents for the amount of hypochlorite used, leaves a net saving in the cost of coagulant of thirty cents per million gallons. The actual saving in the operating expenses really amounts to much more, as to this must be added the saving in wash water and the increased amount of water passing through the filter between cleaning.

The average number of bacteria of all samples of filtered water taken during November was 18 per cubic centimeter, while in December, when the bleach was applied with the coagulant, the average was 8 per cubic centimeter.

Tests also were made to determine the effect of hypochlorite of lime upon water of high turbidity. The results from these experiments have shown that as the turbidity increases, the bacterial efficiency of the hypochlorite decreases. This is partly due to the increase in organic, which invariably increase with the turbidity, and partly to the bacteria being mechanically protected by the particles of matter in suspension. With water having a turbidity greater than fifty parts per million, the hypochlorite of lime gave better bacterial results, when part or all of the turbidity was removed before treating with the chemical. This work has also shown that with the raw water at Avalon, increasing the dose of hypochlorite about 0.10 of a grain per gallon, but slightly increased the percentage reduction in the number of bacteria.

The use of hypochlorite of lime at this plant has shown that:

The effluent from both the slow sand and mechanical filters can be made practically sterile, with the total elimination of B. coli, reducing the color from 5 to 15 per cent.

To reduce the amount of alum and to increase the length of runs between changing the filters, and at the same time reducing the amount of wash water.

Also that hypochlorite of lime is more efficient when used with alum than when used alone.

That high turbidity in the raw water reduces the bacterial efficiency of the hypochlorite of lime.

And that the hypochlorite of lime even when used in large quantities causes but a slight reduction in organic matter.

PERCENTAGE OF RECEIPTS AS COMPENSATION FOR STREET RAILWAY FRANCHISES.

THE following information regarding the practice and the results of assessing percentages of the receipts of street railway companies as compensation to the city for granting the franchise has been gathered in response to an inquiry published in the "Question Department." The data have been collected from various sources and show considerable variation in practice. As stated in the answer to the question referred to, there are other methods of securing compensation for street railway franchises, but on account of the limitations of space they are omitted from this article. All the receipts from the street railway companies are given whenever possible,

for the percentage of receipts may vary on account of the collection of other forms of compensation.

Mobile, Ala., received from its street railroad company in 1907 a percentage of the receipts amounting to $1,436, car license fees of $500 and property taxes of $8,742.

In 1907, Little Rock, Ark., collected $500 fixed annual rental of street car privileges, $3,556 percentage of receipts, $845 license fees and 6,450 property taxes.

California provides for the sale of franchises to the highest bidder and 2 per cent on the gross receipts after 5 years, San Francisco on franchises hereafter granted to receive 3 per cent first five years, 4 per cent next 10 and 5 per cent the last 10 years of their life. Car licenses of $25 are also provided for, except San Francisco, which is 50 a year.

In 1907 San Francisco received $100 annual rental, $35,449 percentage of earnings, $7,478 from license fees, and $277,402 other taxes. In 1906 Los Angeles received from its street railway companies $59,493 in taxes, $9,337 in license fees, and $1,000 payment for public service privileges; in 1907, $800 sale of privileges, $80 annual rental, $2,944 license fees, and $199,122 taxes. Oakland received $40,028 from taxes and $2,617 for privileges; in 1907, $2,750 sale of privileges, $100 annual rental, $3,007 percentage of receipts and $38,198 other taxes. The special report on street and electric railways for 1902 states that Sacramento received $125,000 from street railways in 1902. The gross earnings for the year were somewhat more than $750,000.

In 1906 Denver, Colo., received from street railway companies $70,727 as taxes, $2,972 as license fees and $35,000 for public service privileges.

Bridgeport, Conn., received 5,000, gross earnings about $400,000; Hartford received $21,929 from its several roads, or 2 per cent of the gross fares collected in the city; New Haven collected $2,250 from several roads; and Waterbury $3,177, gross earnings about $200,000, from street railways for public service privileges in 1906. In 1907 Hartford received $7,500 from sale of privileges to street car company, $15,900 from percentage of earnings and $266 other taxes.

Washington, D. C., collects 4 per cent on gross receipts and 1.5 per cent on real estate, amounting in 1907 to $178,776, and also received $11,164 from a charge of ½ cent for each passenger across a bridge.

Jacksonville, Fla., received in 1907 $7,496 from percentage of earnings and $9,608 from other taxes of street railroad property.

Atlanta, Ga., received 1 per cent. of gross earnings the first three years and will receive 2 per cent. the next 20 years and 3 per cent. thereafter during lives of franchises, also a cash payment of $50,000. The receipts in 1906 were $28,049 percentage of earnings, and $33,086 other taxes; in 1907 they were $800 annual rental, $30,984 percentage of earnings, $300 from licenses and $71,458 other taxes.

Chicago, Ill., receives 55 per cent. of the net receipts, which was $53,527 in 1907, in addition to $20,567 from sale of privileges, $112,082 license fees and $601,190 other taxes.

Evansville, Ind., provides for step by step increase from 2 per cent. of gross receipts for first 12½ years to 4 per cent. for last 12½ years of 50 year franchise. In 1900 the payment was $3,485. In 1906 it was $5,467 for franchise privileges and in addition $9,594 in regular taxes and in 1907, $175 for rental of privileges, $5,979 percentage of receipts and $11,410 regular taxes.

Des Moines, Iowa, collects 5 per cent. of gross earnings and regular property tax. The receipts in 1907 were $464 for the former and $17,498 for the latter.

Kansas City, Kan., received $17,442 percentage of receipts, $3,099 annual rental of privileges, $5,979 percentage erty taxes from its street railroads in 1907.

New franchises in Louisiana must be sold to highest bidder on percentage of gross receipts. In 1906 New Orleans received $257,978 in taxes, $12,345 from licenses, and $10,485 for public service privileges from companies operating street railway and combined street railway and electric lighting plants. In 1907 the receipts were $292,047 from taxes, $14,977 from licenses, $1,450 from rental of street car privileges and $30,241 from percentage of gross receipts.

Portland, Me., received $4,000 from percentage of earnings in 1907 in addition to $5,948 in taxes.

Baltimore, Md., receives 9 per cent. of gross receipts and a low car license, amounting to $324,398 in 1900. The gross earnings of the company from all sources were about $4,300,000. In 1905 the city received from the company, which also furnishes some light and has some lines outside the city, about $400,000, in 1906 it received $433,312 for franchise privileges, $3,500 from licenses and $163,278 from taxes; and in 1907 it received $225 annual rental, $430,095 percentage of earnings, $3,750 licenses and $89,044 taxes.

Massachusetts has a very elaborate law governing street railway corporations and their taxes, and the sum of all the taxes provided for amounts to nearly 7 per cent. of the gross receipts. The receipts in cities outside of Boston varied in 1906 from $2,828 for public service privileges and $5,836 from taxes on street railways in Fitchburg to $24,988 for public service privileges and $42,049 from taxes in Springfield. New Bedford collects $3,000 a year license fee. In 1907 these receipts varied from $78 percentage of earnings and $3,105 taxes in Fitchburg, to $22,859 percentage of earnings and $91,618 taxes in Cambridge and $76,953 percentage of earnings and $452,241 taxes in Boston.

In Detroit, Mich., some of the lines pay percentages of gross receipts, 1 per cent, 2 per cent and 2½ per cent and others nothing. The city received $30,823 in 1902 from these percentages. In 1907 the receipts were $6,936 from interurban express service and $48,804 percentage of receipts.

New franchises in St. Paul, Minn., must pay 5 per cent of gross receipts, but this is not retroactive on the older franchises.

St. Louis, Mo., street railroads pay various percentages, and in 1902 the city received $105,858 from special percentage taxes and $24,750 from car license fees at $25 a car. The license fees do not appear in the report for 1906, but the city received $131,573 from franchise payments and $270,489 from taxes on street railroad property; in 1907 the receipts were $106,000 annual rental of privilege, $29,647 percentage of earnings and $418,326 from taxes.

Kansas City railroads paid $124,834 franchise fees in 1906, and $84,367 in taxes. A later franchise assesses company 8 per cent of gross receipts from which city pays county and state taxes, leaving about $120,000 net to the city in one year. The receipts in 1907 were $123,728 from the percentage of receipts, $1,200 annual lump sum payment and $156,443 property taxes.

Lincoln, Neb., received $3,131 percentage of receipts and $10,214 property taxes in 1907.

Newark, N. J., was reported in 1902 to require 5 per cent of gross receipts and license fees of $10 a car. The two amounted to $86,797 in that year and $139,016 in 1907. Paterson's 2½ per cent of gross receipts amounted to $14,636 in 1902, and $30,767 in 1907. Jersey City received in 1907 $3,700 from annual rental, $53,400 from percentage of earnings and $19,379 from property taxes. Other New Jersey cities collected in that year amounts varying from $3,511 percentage of receipts and $990 property taxes in Passaic to $10,799 percentage of receipts and $14,124 taxes in Trenton.

In New York City some street railways pay franchise taxes, but many do not, the franchises dating prior to 1884. The law passed that year requires companies to pay at least 3 per cent of their gross reecipts during the first 5 years and 5 per cent thereafter. Franchises sold to the highest bidder have occasionally gone at a slight increase above this minimum, in one case 3 per cent above. Others require 4 per cent for 5 years, 6 per cent for the next 5, 8 per cent for the next, and 10 per cent for the last 10 years of the franchise period of 25 years. Some of the companies also pay $50 car license fees. In 1902 the total receipts of the city from these sources were $422,177. The following figures are for the year 1907 for the street and elevated roads paying franchise taxes; there are others which pay only license fees and regular taxes, and others only the regular taxes.

Brooklyn City Railroad had gross earnings from operation of 11,469,517.79 and paid franchise tax (F) of $143,580, car license (C) of $14,785, tax on earnings and capital stock (E) of $139,021.36, and tax on property used in the operation of the road (P) of $122,372.71.

The Brooklyn, Queens County & Suburban R. R. Co. had gross earnings of $1,586,507.05 and paid (F) $21,400, (C) $3,041.74, (E) $16,189.02 and (P) $9,600.

The Interborough Rapid Transit Co. had gross earnings of $22,363,802.33 and paid special franchise, personal, etc., taxes of $1,035,102.46; (E) $185,055.83 and (P) $157,806.08.

The Nassau Electric R. R. Co. had gross earnings of $3,167,61552 and paid (F) $60,000, (C) $7,211, (E) $58,945.17.

The total receipts of New York City, taken from the U. S. report for 1907, included $29,460 from car licenses, $9,585 annual rental of privileges and $313,997 percentage of earnings, which amounts do not agree exactly with the sums of the above, probably on account of differences in classification and fiscal year covered and receipts from other roads.

Rochester, N. Y., collects 1 per cent of gross receipts, amounting with a small car license fee to about $30,000 in 1902, although the total gross receipts did not much exceed $1,000,000.

In 1907 the receipts were $23,209 from percentage of earnings, $1,490 from licenses, $59,867 from tax of franchise and $7,865 from other taxes.

Buffalo collects 3 per cent of earnings, which was $85,851 in 1902, and $120,628 in 1907. In the latter year taxes amounting to $56,637 were also collected.

In 1907 Albany received $2,500 from sale of privileges to street car company and $274 percentage of earnings.

Cincinnati, O., collects 6 per cent of the gross receipts, which amounted to $200,000 in 1902, $240,141 in 1906 and $257,086 in 1907. In the latter year the city also collected $2,275 car license fees and $45,214 in regular taxes. Dayton collects $300 a year compensation for privileges, and in 1907 the percentage of earnings brought $14,940, and other taxes $20,535. Cleveland collected in 1907 $3,152 annual rental, $84,488 percentage of receipts, $8,740 license fees, and $135,520 other taxes.

Philadelphia, Pa., requires street railway companies to pave the whole street, and some companies pay a tax of 5 per cent on dividends in excess of 6 per cent. Car license fees of $50 a car amounted to about $100,000 in 1902. The total payments of one company averaged about 7 per cent of the gross receipts in 1900-1-2. Receipts in 1907 were $115,579 from percentage of receipts, $122,204 from car licenses. In Harrisburg the street railway company paid $14,671 in 1906, and $16,461 in 1907 percentage of receipts, and each year a $500 license fee.

Providence, R. I., receives 5 per cent on gross receipts, which amounted to $66,195 in 1902 and $78,103 in 1906. The company paid $38,253 regular taxes also in the latter year. In 1907 Providence collected $1,100 annual rental of franchise, $83,889 percentage on receipts and $60,552 regular taxes. Woonsocket, collecting 3 per cent, received $1,631 in 1902 and $1,231 in 1906, and also $1,231 of regular taxes.

Nashville, Tenn., receives 2 per cent of gross receipts up to $1,000,000 and 3 per cent thereafter. Its receipts in 1907 were $33,143 from the percentage of gross receipts from street railway and lighting company, $750 licenses and $60,160 taxes on property of company.

In 1907 Houston, Tex., received $6,791 percentage of gross receipts of street railroad company and $13,576 taxes on its property. Ft. Worth collected $1,132 percentage on receipts and $8,524 taxes on property.

Richmond, Va., collects 5 per cent of gross receipts, which amounted to $28,121 in 1902 on gross receipts of about $600,000. The collections in 1906 amounted to $13,940 on gross receipts, $1,600 on car licenses and $24,017 regular taxes; and in 1907, $40,452, $1,600 and $30,549 respectively. Norfolk levies 4 per cent on gross earnings, which tax amounted to $12,671 in 1902. In 1906 the collections were $1,000 fixed payment for franchise, $2,700 for licenses and $40,025 for taxes. In 1907 they were $23,813 percentage on receipts, $6,000 for licenses and $32,300 other taxes.

In 1907 Seattle, Wash., collected from street railways $10,000 from sale of privilege, $300 annual rental of privilege, $55,480 for percentage of gross earnings, and $59,781 from taxes. Tacoma collected $15,943 percentage of earnings and $12,012 taxes.

Montreal, Que., receives 20 per cent of gross receipts.

SPECIFICATIONS FOR LAYING BRICK PAVEMENTS.*

ALL brick must be strictly No. 1 pavers of the size commercially known as vitrified block, the width of which must not vary more than one-eighth of an inch.

They must be thoroughly annealed, tough and durable, regular in size, shape and evenly burned.

When broken the block shall show a dense, stonelike body, uniform in color inside, free from lumps of uncrushed clay, lime, air pockets, cracks or marked laminations, kiln marks or surface cracks must not exceed 3-16 of an inch in depth.

All blocks so distorted in burning as to lay unevenly in the pavement shall be rejected.

All blocks shall be tested for abrasion and absorption, the limits of loss by abrasion test and amount of absorption to be determined by the engineer in charge of the work.

The abrasion test shall be made with the rattler recommended by the National Paving Brick Manufacturers' Association and of the following shape and dimensions: A regular fourteen (14) sided polygon, circumscribed around a circle 28 inches in diameter

*Report of Brick and Granite Block Committee of the Organization for Standardizing Paving Specifications.

and the barrel to be twenty inches long with one-quarter (¼) inch spaces between each side, and where cast-iron staves are used, the engineer in charge of the work shall require greater loss from abrasion than when steel is used.

Note.—In view of the fact that the National Paving Brick Makers' Association is now considering a modification as to dimensions and materials of the "rattler" now and for some time in use, your committee advise that questions touching the "rattler" be not considered until after the association have reached a conclusion and made a recommendation as to this appliance.

For the information of the convention we submit a tentative report on the "rattler" made by the National Paving Brick Makers' Association, together with plans and specifications for "rattler," and with the suggestions for tests.

All blocks shall be laid on a six-inch concrete base with sand cushion. The sand cushion shall be clean, sharp sand, spread to a uniform surface to conform to the cross-section of the finished pavement; the sand cushion to be slightly mostened and rolled with a hand roller weighing not less than ten pounds per inch of width. The depth of sand to be not less than 1½ inches nor more than 2 inches after rolling.

CEMENT FILLER FOR BRICK PAVEMENTS.

Your committee, after considering this matter carefully, beg leave to report the following and recommend its adoption:

The filler shall be composed of one part of clean, sharp sand and Portland cement. The sand should be dry. The mixture, not exceeding one-third bushel of the sand, together with a like amount of cement, shall be placed in the box and mixed dry until the mass assumes an even and unbroken shade. Then water shall be added, forming a liquid mixture of the consistency of thin cream.

The sides and edges of the brick should be thoroughly wet before the filler is applied by being gently sprinkled.

From the time the water is applied until the last drop is removed and floated into the joints of the pavement, the mixture must be kept in constant motion.

The mixture must be removed from the box to the street surface with a scoop shovel, all the while being stirred in the box as the same is being thus emptied. The box for this purpose shall be four feet eight inches long, thirty inches wide and fourteen inches deep, resting on legs of different lengths, so that the mixture will readbottom of which should be six inches above the pavement. This mixture, from the moment it touches the brick, should be thoroughly swept into the joints.

Two such boxes shall be provided in case the street is twenty feet or less in width; exceeding twenty feet in width, three boxes should be used.

The work of filling should thus be carried forward in line until an advance of fifteen to twenty yards has been laid, when the same force and appliances shall be turned back and cover the same space in like manner, except to make the proportions two-thirds Portland cement and one-third sand.

To avoid the possibility of thickening at any point, there should be a man with a sprinkling can, the head perforated with small holes, sprinkling gently the surface ahead of the sweepers.

Within one-half to three-quarters of an hour after this last coat is applied and the grout between the joints has fully subsided and the initial set is taking place, the whole surface must be slightly sprinkled and all surplus mixture left on the tops of the brick swept into the joints, briging them up flush and full.

Note.—Where a stronger filler is desired pure cement may be used.

After the joints are thus filled flush with the top of the brick and sufficient time for hardening has elapsed, so that the coating of sand will not absorb any moisture from the cement mixture, one-half inch of sand shall be spread over the whole surface, and in case the work is subjected to a hot summer sun, an occasional sprinkling, sufficient to dampen the sand, should be followed for two or three days.

Note.—Where streets cannot be kept closed long enough to permit cement grout to properly set, or on account of any other local conditions, a bituminous filler may be used.

After brick in pavements are inspected and the surface is swept clean the pavement shall then be rolled with a roller weighing not less than three nor more than five tons in the following manner: The brick next the curb should be tamped with a hardwood tamper to the proper grade. The rolling will then commence near the curb at a very slow pace and continue back and forth towards the center, until the center of the street is reached, then passing to opposite curb and repeat in the same manner to the center of the street. After this first passing of the roller the pace may be quickened and the rolling continued until each brick

is firmly imbedded in the sand cushion. The pavement shall be rolled transversely at an angle of 45 degrees from curb to curb, repeating the rolling in opposite forty-five-degree direction. Before and after this transverse rolling has taken place, all broken or injured blocks must be taken up and replaced with perfect ones. The substituted blocks must be brought to the true surface by tamping.

Expansion joints shall be placed parallel with and at each of the curb lines and shall not be less than one inch in width. Said joints shall be filled completely with bituminous cement.

SPECIFICATIONS FOR GRANITE PAVING BLOCKS.*

YOUR committee in considering this question decided at this time to only recommend certain dimensions and features in regard to the blocks themselves, rather than a complete set of specifications for this form of pavement.

It is believed that the adoption of certain standard dimensions for the blocks will result in having the several quarries improve the output of paving blocks and enable them to furnish a standard block more expeditiously, and it is hoped, at not to exceed the cost which now maintains.

DIMENSIONS OF BLOCKS.

First. It is recommended that the depth of block be five inches, with an allowable variation of one-quarter inch greater or less in said depth.

Second. The blocks shall be so dressed that they can be laid with one-half-inch joint for a distance of one inch down from the head, the individual joints to be measured. The joint not to exceed one-half inch at the top nor to be more than one inch in any part of the joint.

Third. The block to be from eight inches to twelve inches in length.

Fourth. The block to be from three and one-half inches to four and one-half inches in width for ordinary conditions, with a suggestion of greater width to be allowed for streets of flat grades; said width to be specified in each individual contract.

Fifth. The head of the block shall be so dressed that it shall not have more than three-eighths-inch depression from a straight edge laid in any direction across the head and held parallel to the general surface of teh block.

*Report of Brick and Granite Block Committee of the Organization for Standardizing Paving Specifications.

SPECIFICATIONS FOR MACADAM PAVEMENTS.*

INASMUCH as macadam is one of the lowest classes of pavement and one of the most cheaply constructed, the general tendency seems to have been to pass over the specifications for its construction hurriedly, and on the part of many engineers and city officials not nearly enough attention has been paid to details. The successful use of crushed rock as a paving material depends altogether on this same attention to detail.

While in the construction of any class or type of paving local conditions of weather and traffic largely govern, it is in the construction of macadam pavements that the engineer must give greatest weight to surrounding circumstances. The kind and condition of the soil, the character and quality of the stone, the class and the volume of traffic, must all be closely scrutinized and carefully considered in the preparation of specifications if first-class macadam construction is to result.

In some localities a Telford foundation is better, and in others the macadam is considered superior. To meet the individual preferences of road builders your committee has prepared specifications covering both forms.

Your committee unanimously concurs in the belief that a modern macadam pavement can hardly be considered finished until it has been given some binding treatment, and the specification has been prepared with an ultimate treatment with some bituminous compound in view. We have considered treatment by penetration only, however, as other methods would more properly come before your committee on asphalt and bituminous macadam.

In the limited time at the disposal of

*Report of Committee on Macadam of the Organization for Standardizing Paving Specifications.

your committee it has been impossible to go fully into the merits of the various tars and bitumens offered by the manufacturers for macadam road treatment. In this specification we have endeavored to indicate a method of application which would generally be attended with successful results. However, in the use of these materials it is recommended that the engineers consult with the manufacturers and so amend this specification that it will comply with their requirements.

It is further recommended that careful consideration be given the physical and chemical requirements of the bituminous treatment and that they be specified by such requirements rather than by trade names.

SUB-GRADE.

The portion of the roadway indicated shall be excavated from the present surface thereof to a sub-grade, which, when properly prepared, in the case of Telford foundation, shall be 14 inches and in macadam foundation shall be 12 inches, below and parallel with the surface of the completed pavement. Said completed surface shall conform to the general cross-section of the street as indicated, and shall be thoroughly cleared, all stumps, roots and sod or other vegetable matter removed, and the sub-grade shall be rolled with a steam road roller weighing ten tons, so the surface shall be exactly parallel with the proposed finished surface. All soft or spongy places shall be excavated and refilled solidly with gravel, broken stone or approved earth before the completion of the rolling. If, by reason of steep grades or other circumstances, it is deemed impracticable to use the steam road roller, the contractor will be permitted to use an approved horse roller upon application to and with the consent of the proper authority.

TELFORD FOUNDATION.

Upon the sub-grade thus prepared, rolled and accepted, there shall be placed a foundation of clean, hard, sound stone, broken into sizes which shall come within the following dimensions: Four to eight inches in width, eight to fourteen inches in length, and not less than eight inches in depth. The stone shall be placed by hand vertically upon the broad edge and lengthwise across the roadway, so as to form a close, firm foundation from gutter to gutter. The projection of the stones above and below surface eight inches above the sub-grade shall be broken off with napping hammers and the pieces so broken off, together with other stones of suitable size and shape, shall be used as wedges to firmly fix the stone of the foundation in proper position, so that its top surface will be parallel to the sub-grade of the roadway and eight inches above it.

Upon the roadway thus prepared there shall be spread a layer of good, clean earth, preferably clayey loam, not to exceed one inch in thickness. The foundation shall then be thoroughly rolled with a steam road roller weighing not less than ten tons. In places where rolling is impracticable, the foundation shall be rammed with suitable rammers, with the approval of the proper authorities.

MACADAM FOUNDATION.

Upon the sub-grade prepared in the manner above described shall be spread a layer of broken stone which, when thoroughly compacted as herein provided, shall be not less than six inches in depth. The stone in this layer shall be practically uniform in quality and as near an approach to a cube as possible, and broken so that its greatest dimension shall not exceed four inches and the smallest dimension not less than two inches; all to be free from dust, dirt and screenings. All stones which do not approach uniformity of measurement shall be rejected and removed from the roadbed. No stones shall be allowed to remain which are not sound, strong and equable in size and quality. This layer of stone shall be thoroughly rolled with a steam road roller weighing not less than ten tons without the application of water.

SECOND COURSE

Upon the above described foundation shall be placed a layer of broken stone whose greatest dimension shall not exceed two inches and the least dimension shall not be less than three-fourths of an inch, to a depth which, when compacted as herein specified, shall be four inches. This stone shall be thoroughly rolled with a ten-ton steam road roller and sufficient clean stone screenings and water shall be spread over its surface to afford, when the rolling is completed, a practically smooth, dense and hard surface. When the second course as herein specified is completed there shall be spread upon it a layer of stone ranging in size from one inch to one-half inch in the greatest dimension, which, when compacted, shall be two inches in depth. This latter shall be thoroughly rolled and compacted with the ten-ton roller without the application of water until the stone ceases to

creep before the rolls of the machine. The rolling herein specified must be generally begun at the curb or gutter line and rolled from curb to crown, the shoulders first being rolled so as to prevent the spreading of the stone.

BITUMINOUS FILLER.

After the macadam pavement, as above specified shall have been thoroughly rolled and when it is in a bone-dry condition, it is to receive a bituminous treatment applied as follows: The surface must be clean, free from dust, dirt or foreign matter, the bitumen applied in an approved manner and at a temperature of not less than .... degrees Fahrenheit and in sufficient quantity to cover all parts of the surface and in quantity not less than one and one-half gallons and not more than two gallons to a square yard of surface. After the application of the bitumen and after it has had time to set, there shall be applied a coating of clean stone chips whose greatest dimension shall not exceed one-half inch and whose smallest dimension shall be no less than one-fourth inch, sufficient to absorb all of the excess of bitumen, and the whole shall be rolled and re-rolled until it presents a smooth, hard, dense and granular surface.

BONDS AND GUARANTEES FOR PAVEMENTS.*

THE committee finds upon examination among its members and from conference with other delegates, that the practice of providing for the maintenance of pavements upon completion and requiring a guarantee to insure the faithful execution of the obligation is common to all the cities.

The period of such maintenance and the methods of guarantee are widely different. Ten years of maintenance are still insisted upon in some cities for all classes of pavements, five years for soft pavements and three years and one year for the hard pavements are required in others, and in the city of Baltimore City Engineer Fendall has recommended to his City Council, without the prospects of adoption, that maintenance periods be eliminated altogether from their contracts, because he believes that unnecessary amounts are being paid out for maintenance, and that it is practicable to establish and operate a system of inspection that will afford every reasonable and necessary assurance that the contract in all respects, both as to materials and labor, has been properly executed.

The usual practice to insure the faithful performance of the contract to maintain the pavement for a given period is to resort to a guarantee bond. In the majority of cases this bond is required to be that of a bonding company, although since the bonding companies have declined to write ten-year risks, those cities asking for ten-year guarantees have been obliged to accept personal bonds for five years of the period.

Until recently this practice was general, but experiences related by several of the cities and referred to hereinafter, have lead to the adoption in some cases of a further safeguard to insure the maintenance of the pavements.

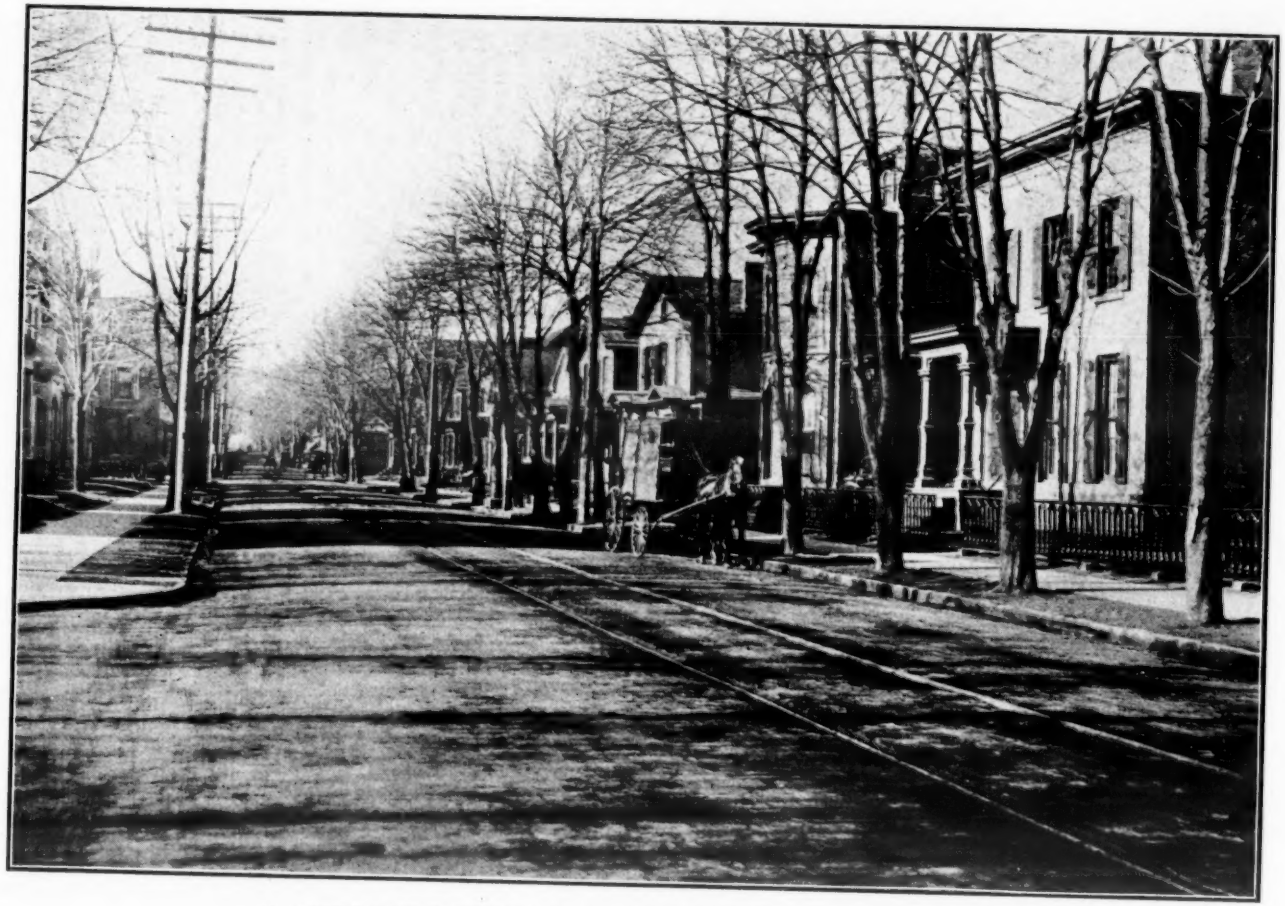
This further safeguard is the requirement that at the close of the construction work there shall be left with the city a cash deposit or its equivalent, which may be used for the purpose of making repairs in case the contractor fails from any cause to meet his obligation during the life of his contract. The money is to be returned during or at the expiration of the period, provided the contract has been fulfilled.

In some cases, in fact, the majority of cases, brought to our attention, both the cash reserve and the guarantee bond are required to be given, with the object of doubly insuring the proper maintenance. In New Orleans alone for the past year and a half the use of maintenance bonds has been abandoned because in every case of default it was not possible to recover on the bond, and instead a cash reservation, equal to 15 cents per square yard in the residential districts and 25 cents per square yard in the business districts, has been made to guarantee the maintenance.

Taking into consideration all the facts brought to our attention, we have concluded to make the following recommendations:

First. That all pavements, any portion of which is constructed of materials of a perishable nature, among which we would include asphalt, bitulithic or bituminous macadam and wood block, or other pavement requir-

*Report of Committee of the Organization for Standardizing Paving Specifications.



I. COURT STREET MEDINA BLOCK STONE PAVEMENT, ROCHESTER, N. Y.

ing special equipment to lay and maintain, and also such pavements as are of a patent or proprietary nature, new or more or less experimental in character, shall be required to be maintained for a period of five (5) years from the first day of July next following completion.

Second. That all pavements composed of materials more durable in character, among which we would include stone block, vitrified brick and well-established Portland cement concrete pavements, shall be required to be maintained for a period of one (1) year from the first day of July next following the completion.

Third. That in the case of all pavements a cash deposit, or its equivalent, of ten (10) per cent. of the contract price per square yard for each square yard of pavement be retained for the whole of the maintenance period, said sum, with its accumulations, if any, to be paid in full to the contractor if he fulfills the terms of his guarantee. The reservation is to be subject, however, during the maintenance period, for use by the city in making such repairs as are necessary and have been neglected or ignored by the contractor. In the latter case the balance of the fund, if any, shall be returned to the contractor at the end of the maintenance period.

Fourth. We further recommend that if the bonding companies will offer a uniform and standard form of guarantee, satisfactory in form and cost to the cities, members of this association, which will protect the cities as amply and accomplish the purpose of keeping the pavements in repair as fully as may be done by the cash reserve plan, a guarantee bond in twice the amount of the established cash reserve be accepted in lieu thereof.

Fifth. In case of the satisfactory adjustment in the guarantee plan and its adoption by this association, it is further recommended that any default on the part of any bonding company in any of the cities of this association shall be reported to its secretary, and it shall be his duty to report to each of the said cities on account of such default.

Our conclusions with respect to the period of maintenance for pavements like asphalt are based on the theory of the execution of the construction under specifications permitting the contractor to use his own judgment between certain limits in manufacturing the pavement, thus assuming to himself the responsibility and risk of its success and relieving the city therefrom.

If it is the determination of the convention to adopt close-drawn specifications for asphalt and similar pavements, taking over to the city the full responsibility for the manufacture and construction of the pavement, our views upon this subject will have to be modified.

We offer in explanation of our recommendations the following reasons:

We recommend in the case of the so-called soft pavements a maintenance period of five (5) years.

First. Because it is deemed necessary on account of the nature of the materials used and the method of manufacture to require that length of time to fully demonstrate that the original work was executed strictly in accordance with the specifications and to develop defects in materials or workmanship.

Second. Because of the variation in the sizes and resources of the several cities interested and the impracticability of establishing and maintaining in each the expert, technical and practical service, as well as the special apparatus and equipment to properly inspect an original construction and subsequently maintain it.

Third. Because a longer period is not required for any practical purpose and imposes on the taxpayer in advance the cost of maintaining the pavement during a period too remote and under conditions too speculative to permit a proper estimate of the cost to be made in advance.

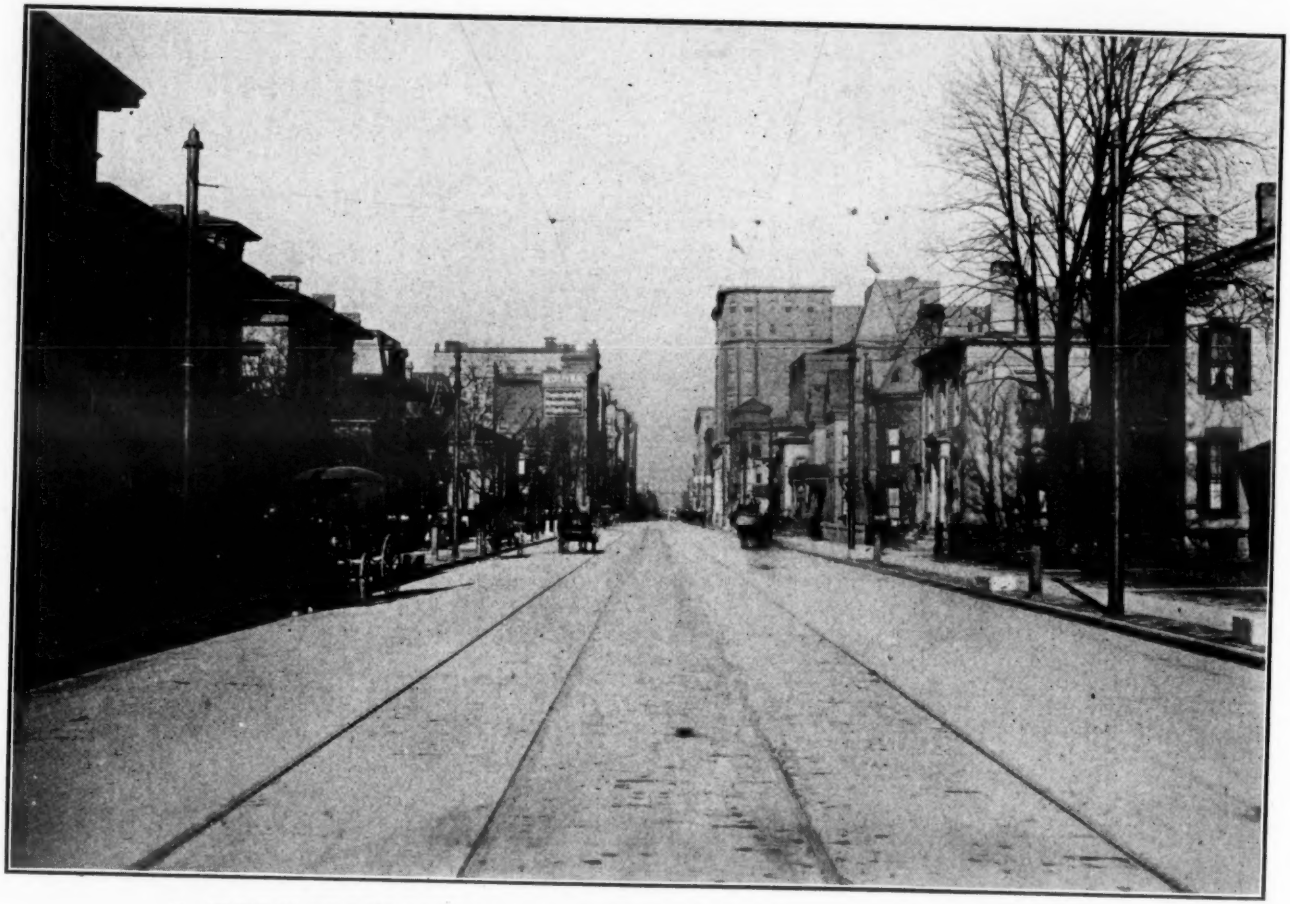
It is believed by your committee to be a better business proposition to save to the taxpayer the money which may be required for maintenance subsequent to five (5) years until it is demonstrated that it is needed for the purpose.

We recommend in the case of the more durable pavements a maintenance period of one (1) year only.

First. Because the nature of the materials used and the work of construction are easily and readily specified and inspected, and all defects of workmanship and material will be developed in the period recommended.

Second. Because the materials required for repairs may be purchased in the open market under competition, and the work done with the ordinary tools and appliances and skilled labor at hand.

Third. Because the repairs required upon this class of pavement amount to little or nothing during a number of years of its life, in fact and as a rule, none until such time as the whole surface is in a condition to require re-



II. CLINTON AVENUE, SOUTH, ASPHALT AND WOOD BLOCK PAVEMENT, ROCHESTER, N. Y.

paving. The taxpayer may as well be saved the expense imposed by a requirement to maintain from which he obtains no service or other return.

We recommend the adoption of a cash reserve in place of the present bonds written by the bonding companies, and in place of the double provision of a cash reserve together with a like bond.

First. Because in the first of the above instances it has been brought to our attention that in several of the cities consulted some of the bonding companies have refused to make good the default of the contractor, and upon the expenditure of the money by the city pursuant to the terms of its contract to carry out its provisions have contested the demand of the city to be reimbursed and demonstrated in court the insufficiency of its guarantee by its success in the proceeding.

We believe that the cost of the guarantee by means of the cash reserve will be less than that required to provide a guarantee bond, and that the difference should be saved to the taxpayer. Again, it is essential and of prime importance that repairs should be made when they are needed, and by the adoption of a cash reserve scheme this object may be accomplished, and law suits, if they must come, carried on while the pavement is in good and safe condition.

Second. Because in the second of the above instances if the cash reserve scheme is sufficient to accomplish the desired object of keeping the pavement in good repair for the period specified, and we believe it is, the further requirement of furnishing the bond is superfluous and adds just so much unnecessary cost to the work and to the taxpayer, and consequently should be dispensed with.

Your committee believes that there should be a more definite determination of conditions to be fulfilled under the maintenance and its guarantee. Such requirement should be special for the various kinds of pavements, but should be definite as to the condition requisite for the acceptance of the work and release of the guarantee.

PUBLIC IMPROVEMENTS IN ROCHESTER, N. Y.

FOR the accompanying photographs and for the information regarding the improvements shown in them we are indebted to Mr. E. A. Fisher, the city engineer of Rochester, whose efficiency is shown by his continuance in office through many changes in administration, and who is responsible for the excellent quality of the work.

The first plate shows a Medina block stone pavement laid on Court street in 1907. The Medina block stone pavement is one which originated in Rochester. It is of the same sandstone of which many streets have been laid in this and other cities, but the blocks have been carefully dressed until they can be laid with narrow joints and a surface almost as smooth as a brick pavement. Care being taken to select blocks of uniform texture and hardness, the pavement retains its good qualities almost indefinitely.

Several short pavements of the same sort have been laid on this street, ranging in price from $3.50 a square yard for one laid in 1894, to $2.60 in 1897 and $2.80 for that shown. The pavements are laid on 6-inch concrete foundation, the earlier ones having a pitch filler and the latest cement grout. The street is 29 feet between curbs. The street railway track is laid on wooden ties set on concrete and the track is 93-pound 8¾-inch step rail. The cost of the pavement of the track was $2.90 per square yard.

The second plate shows Clinton avenue, south, which was finished in December, 1906. This entire pavement was paid for by the street railway company. It is composed of asphalt on the driveways, wooden block between the rails and tracks and a small amount, about 5 per cent of the total area, of Medina stone block. The construction of street car track is the same as on Court street, except that the rail is a 104-pound 9-inch girder. The asphalt pavement cost $2 a square yard, the wood block $3.40, and the Medina block $2.15.

The third photograph shows the Field street brick pavement, a half mile long and 26 feet wide, completed in 1907. The pavement was laid on 6-inch concrete foundation with Calder brick, cement grout filler and expansion joints of pitch. It cost $2 a square yard with a 10-year guaranty.

III. FIELD STREET BRICK PAVEMENT, ROCHESTER, N. Y.

RATES FOR TUNGSTEN STREET LAMPS.

By Alton D. Adams, Rochester, N. Y.

TUNGSTEN lamps have displaced the majority of the carbon incandescents and also many arcs on the streets, to the extent of more than thirteen thousand in a single state.

No less than 26 cities and towns in this same state have more than 200 tungsten street lamps each, eight municipalities have more than 500 of these lamps, respectively, and one city has 1,157 such lamps.

This extensive use of tungsten lamps has created a new situation as to rates for street lighting, owing to the fact that the tungsten filament requires only 36 per cent as much energy per candle power as the regular 3.5-watt carbon, to the higher renewal cost of the tungsten lamps, and to the investment in new fixtures where these lamps are installed.

Though the 40-and 60-candle power series tungsten lamps sell at the same price, and the 80 candle size costs only 20 cents more, the majority of the tungsten street lamps installed are unfortunately of 40 candle power. Thus in the state under consideration only three cities had more than 200 tungsten lamps of 60 candle power, and the 80 and 100 c.p. sizes are used there to only a small extent.

In one town of the state there are 23 of the 200 candle power series tungsten lamps on the street, and a few are found in other places. Much the greater number of the tungsten lamps are operated with 6.6 amperes, but the 40-candle size is found on circuits that carry 1.5 to 7.5 amperes.

With the higher candle powers and much higher efficiency of the tungsten lamps there have come some changes in the rates per lamp-year and lamp-hour, and a much greater change in the rates per kilowatt hour for energy used at the street lamps. Looking over a list of some fifty cities and towns using tungsten street lamps in the state under consideration, the rates per kilowatt hour on the basis of the energy consumed in the lamps range from as much as 20 cents down to 5.06 cents. The rate of 20 cents per kilowatt hour applies in a town where 232 lamps of 40 candle power are operated 1,440 hours per year at the price of $14.40 each, or one cent per lamp-hour. For the rate of 5.06 cents per kilowatt hour seventy lamps of 60 candle power were operated 3,965 hours at the yearly rate of $15.00 each, or 0.38 cent per lamp-hour. Between these extremes a great part of the tungsten street lighting is done at rates from about 7 to 12 cents per kilowatt hour on the basis of the energy used in the lamps at normal rating.

SOME TUNGSTEN STREET LAMPS IN CITIES AND TOWNS OF ONE STATE.

Number of Lamps in City or Town	C.P.	Yearly Hour	$ Yearly Rate	Cents per Lamp-Hour	Cents per K. W. H.
210	40	1,512	14.58	0.96	19.2
215	40	1,524	14.61	0.95	19.0
231	40	1,548	14.67	0.94	18.8
232	40	1,440	14.40	1.00	20.0
245	40	2,979	17.00	0.57	11.4
269	40	2,293	16.53	0.72	14.4
284	40	1,607	14.81	0.92	18.4
284	40	2,412	16.83	0.70	14.0
334	40	3,965	15.00	0.38	7.60
336	40	2,164	19.00	0.87	17.4
351	40	2,215	18.00	0.81	16.2
421	40	3,009	18.32	0.608	12.1
500	40	3,900	25.00	0.64	12.8
518	40	1,619	14.84	0.916	18.3
556	40	2,263	16.32	0.72	14.4
558	40	3,898	22.50	0.57	11.40
572	60	3,828	23.40	0.613	7.66
325	40	2,457	17.50	0.71	12.2
270	60	2,457	17.50	0.71	9.4
637	40	1,706	15.00	0.87	17.4
659	40	3,827	20.36	0.53	10.6
704	60	2,842	20.53	0.72	9.6
1157	40	3,049	18.75	0.61	12.2

The accompanying table shows the numbers, candle powers, hours of annual operation and rates for tungsten street lamps in twenty-two cities and towns of the state under consideration that contain more than 200 such lamps each. Several municipalities that operate more than 200 tungsten street lamps are not included in the table, because no definite rate could be named for the service.

It is to be noted that the higher rates per lamp-hour and per kilowatt-hour go in the main with the short hours of annual operation, say under

2,000, while the lower rates per lamp-hour correspond with 3,800 to 4,000 hours of lighting, and with the use of 60 candle power rather than 40 candle power lamps.

Thus in the six towns where the annual hours of operation were under 1,700 the range of rates was 18.3 cts. to 20 cts. per kilowatt-hour, with 40 candle power lamps. On the other hand, in the four places where 40 candle power lamps were operated more than 3,800 hours per year the rates per kilowatt-hour were 7.6 to 12.8 cents per kilowatt-hour. For the three groups of 60 candle power lamps the rates were 7.66 cents to 9.6 cents per kilowatt-hour with lighting hours of 2,457 to 3,828. Per hour of lighting, the 40 candle power lamps cost 0.38 to 1.00 cents, and the 60 candle power lamps 0.61 to 0.72 cent.

The lower rates go with the longer hours of lighting rather than with the larger numbers of lamps per city.

A company that operates thousands of tungsten street lamps in about a score of cities and towns has adopted a uniform method of charging for this service, the basis being a fixed yearly rate per lamp plus an additional amount for each hour of operation.

The large number of municipalities and street lamps to which these tungsten rates apply makes them of especial interest, and the following analysis is therefore presented. For the several candle powers the base rates are as follows, the fixed rate for each lamp applying without regard to the number of hours that the lamp is operated.

C. P. of Lamp	Fixed Rate per Lamp-Year	Operating Rate per Lamp-Hour
40	$10.80	0.25 cent
60	12.00	0.30 cent
80	14.00	0.40 cent
100	18.00	0.50 cent

It is evident that this method of charging is intended to give a certain return on the investment independent of the hours of lighting, and that the total rates per lamp-hour grow rapidly less for longer service. This is shown in the following table that gives the total rates per lamp-hour, from 1,000 to 4,000 hours yearly. For the 40 candle power lamp the total rate per hour for 1,000 hours of operation yearly is 1.33 cents, while for 4,000 hours of operation the total rate is only 0.52 cent, or 46 per cent of the former. A similar relation holds for each of the other candle powers.

TOTAL CENTS PER LAMP-HOUR FOR EACH CANDLE POWER.

Hours of Operation Yearly	40 C. P.	60 C. P.	80 C. P.	100 C. P.
1,000	1.33	1.50	1.80	2.30
1,500	0.97	1.10	1.33	1.70
2,000	0.79	0.90	1.10	1.40
2,500	0.682	0.78	0.96	1.22
3,000	0.61	0.70	0.886	1.10
4,000	0.52	0.60	0.75	0.95

As the rate per hour for operation is constant with each size of lamp, the lower total rates with long hours are due to the reduction of fixed charge per lamp-hour. This fixed charge per lamp-hour obviously varies inversely as the hours of operation, being only one-fourth as great in each case with 4,000 as with 1,000 hours of annual lighting.

With only 1,000 hours of lighting per year, the fixed rate amounts to about 80 per cent of the total rate per lamp-hour, being 1.2 cents out of 1.5 cents with the 60 candle size. For 4,000 hours of lighting annually, however, the fixed rate becomes approximately equal to the charge for operation per lamp-hour. Thus with the 60 candle power lamp lighted 4,000 hours per year, the fixed rate and the rate for operation are each 0.3 cent per lamp-hour.

If the total rate for the service is stated as a price per kilowatt-hour for the normal consumption of energy in the lamps, the kilowatt-hour rate goes up on the short hour service, but falls off rapidly with long hours. This result is exhibited in the following table, giving cents per kilowatt-hour, with 1,000, 2,500 and 4,000 hours' operation.

Hours	Cts. 40 C. P.	Cts. 60 C. P.	Cts. 80 C. P.	Cts. 100 C. P.
1,000	26.6	20.0	18.0	18.4
2,500	13.6	12.0	9.6	9.7
4,000	10.4	8.0	7.5	7.6

For the 40 candle power lamp the total rate amounts to 26.6 cents per kilowatt-hour, with 1,000 hours of annual lighting, and to 10.4 cents with 4,000 lighting hours. With the 80 candle power lamp the corresponding figure is 18.0 cents per kilowatt-hour for 1,000 hours of lighting, and 7.5 cents per kilowatt-hour for 4,000 lighting hours.

Total rates per lamp-year are exhibited in the following table, for 1,000 to 4,000 hours of lighting.

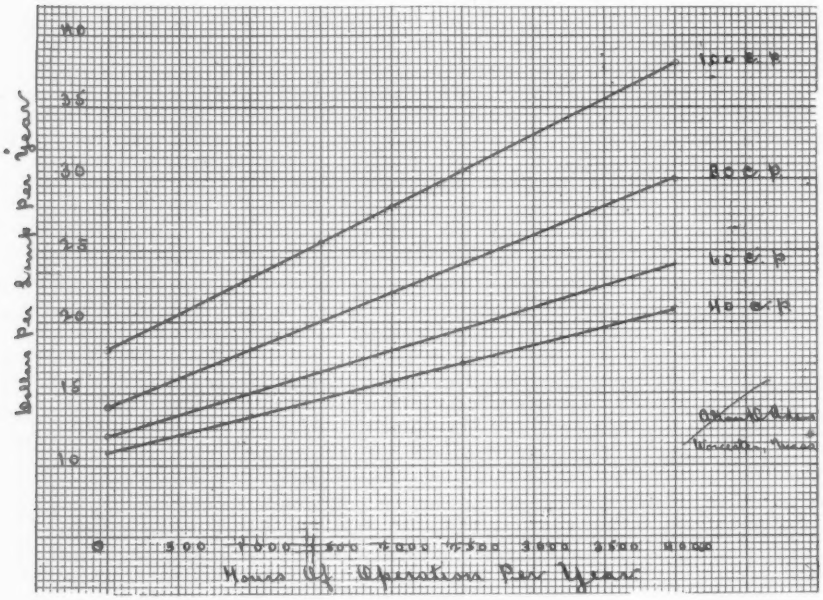
Hours Operated Yearly	40 C. P.	60 C. P.	80 C. P.	100 C.P.
	$	$	$	$
1,000	13.30	15.00	18.00	23.00
1,500	14.55	16.50	20.00	25.50
2,000	15.80	18.00	22.00	28.00
2,500	17.05	19.50	24.00	30.50
3,000	18.30	21.00	26.00	23.00
4,000	20.80	24.00	30.00	38.00

Comparing the annual rates with 1,000 hours of lighting and the annual rates with 4,000 hours, it will be noted that the latter are 56 per cent higher in case of the 40 candle power lamp, and 60 to 66 per cent higher for each of the other three sizes.

While as little as 1,000 hours of street lighting annually is found only in exceptional instances, 1,500-hour lighting is common on short moon schedules, while 2,500 hours is the approximate duration of half-night operation on every day of the year. Full all-night and every night lighting amounts to about 4,000 hours.

As shown in the table, the total annual rate for a 40-candle power lamp is $14.55 when burned 1,500 hours, and $20.80 when burned 4,000 hours. For a 100-candle power lamp the 1,000-hour rate is $23.00 and the 4,000-hour rate, $38.00.

The accompanying diagram is constructed on the basis of the table of total annual rates, and brings out more clearly the moderate increase of rate with long-hour lighting, and the relative rates for the several sizes of lamps. Reduced to figures, the annual rates for the larger lamps as percentages of the 40-candle power rates are as follows.



Hours Lighted Annually	40 C. P. Rate Per Ct.	60 C. P. Rate % 40 C.P.	80 C. P. Rate % 40 C.P.	100 C. P. Rate % of 40 C.P. Rate
2,500	100	115	140	178
4,000	100	115	144	182

For full half-night and all-night lighting, it thus appears that the 40-candle power light may be increased 50 per cent for a 15 per cent higher rate, and 100 per cent for a 40 to 44 per cent higher rate.

EDITORIAL COMMENT

A National Department of Public Health—Uniform Accounts and Reports—Standard Paving Specifications — Co-operative Franchises for Municipal Public Service Corporations — Legislation Concerning Licensing of Engineers.

A NATIONAL DEPARTMENT OF PUBLIC HEALTH.

A bill has been introduced in the United States Senate which, in effect, proposes to elevate the Marine Hospital service to the dignity of a separate department, whose head shall be a cabinet officer, and to transfer to this department all the sanitary and health activities of the various departments except possibly the detail of the hospital service of the army.

Were the effect of the bill simply to recognize in this most pronounced way the efficient service of this bureau the bill could scarcely be supported. But the importance of proper control of many agencies inimical to health is now more fully recognized than ever before and the necessity that this control shall be expert is self-evident. At present several departments have been obliged to pay greater or less attention to health and sanitation on account of the demands of their service, but the result has been more or less unsatisfactory, except where it has been possible to press the Marine Hospital organization into the service.

There have been numerous deplorable occurrences on account of the division of responsibility on such matters, the administration of laws by ignorant officials unable to make proper distinctions, the suppression of efficient workers in sanitation by superiors interested in the business rather than the sanitary effects. To mention but two of widely different natures: The detention of a wealthy foreigner going to Arizona for treatment for tuberculosis, as though he were an ignorant and indigent immigrant; and the suppression of news and denial of the bubonic plague at certain ports, resulting in wide spread of the disease.

Then there are interstate matters of sanitation connected with transportation, pollution of streams, and the like, which require treatment by a department which is devoted to this duty, and is not a subordinate bureau in a department which may be interested in nullifying the efforts of the health bureau, or may be accused by other departments of interfering in their work.

The importance of the sanitary work of the country at large is rapidly becoming great enough to warrant the erection of its organization into a department co-ordinate with the other great departments of the government, and if this fact is not recognized by the present Congress it will be by another in the near futere.

UNIFORM ACCOUNTS AND REPORTS.

The report of the committee of the American Water Works Association on a uniform system of accounts and reports for water supply enterprises, made to the New Orleans convention, is the most complete treatment of this subject which has yet appeared. The details are worked out for the items of water works systems, but the general plan can be used for any public service industry which is required to make periodical reports or which desires to be able to compare its cost of operation for various periods and to know what its financial status is at any given time. The report covers 326 pages and is printed in separate form that it may be used by all those interested in the subject. A general conference of representatives of all interested bodies of men is proposed, and this report will form a most satisfactory basis for the discussions at such a conference.

The report seems to be built on large enough scale to cover the most extensive water works system, but need not on that account frighten the superintendent of the small plant, for by a process of elimination of items not included in his system and combination of items not important enough in his system to warrant separate accounts, he can follow the plan of the report and gain all of its advantages in the way of ability to analyze the operations of his plant and to make the uniform reports, more of which are demanded each year by the legislation of the various states.

Indeed much of this elimination and combination is already done for him by such publications as the American

Water Works Standard Bookkeeping System, which is built on the same lines followed in the committee's report. The divisions of the report consider in full detail the terminology of balance-sheet accounts, of revenue and expense accounts, the requisites of a system of uniform accounts and its use, general rules and instructions for installing a system, the classification of accounts and instructions concerning treatment of fixed assets, floating and nominal assets, liabilities, proprietary interests, operating revenues, operating expenses, miscellaneous revenues and expenses, all carried to all the details found in any existing plant, instructions for profit and loss allocation, and a form of annual report of water works schedule.

The last named form is somewhat more detailed than the form which has been used heretofore and supplies very satisfactorily the omissions from that form, particularly as to assets and liabilities, profit and loss, cost of system, details of pumping and purification plants and details in items of revenue and expense.

The report marks a distinct advance in the discussion of this question and deserves adoption by all the bodies interested practically in the form in which it is presented.

It may well serve as a model for work on the accounts and reports of other public service industries.

LEGISLATION CONCERNING LICENSING OF ENGINEERS.

The introduction of a bill in the New York Legislature which proposes to license civil engineers in that State and the request from the legislator introducing the bill for the support of the American Society of Civil Engineers has forced upon that body the consideration of a subject which has heretofore been sidetracked whenever it has been brought up by any interested member.

Withdrawal of the bill for a time to permit closer consideration of the subject has been secured, but the matter must be considered promptly if the legislation of the State is to be guided in any measure by those most directly interested in it.

The editorial on "Qualifications of Engineers and How to Determine Them" in the April number of Municipal Engineering suggests a method which is perfectly feasible, is a protective measure for the State and the municipalities and counties within its borders and can not be objected to by anyone not serving such corporations in a technical capacity.

The plan may be stated in a little greater detail as an organization for determining the qualifications of engineers seeking employment from state, county, city or board having charge of public construction work, and fixing the minimum of such qualifications necessary to authorize the administrative officers to employ such applicants or engineers to whom they may offer employment.

The character of the machinery for carrying on this work must be determined according to the necessities of the case in any given state. In New York, where there are great engineering organizations within the great city and other great engineering organizations in charge of state boards and departments, there must be a more flexible central organization than in a state where the engineering work is less extensive and the principal offices to be filled are those of city and county engineer and their subordinates, and an occasional engineer of a state or county or city board.

A state board of examiners of engineers is the most obvious director of such an organization, and it should be given considerable leeway, although some restrictions upon its action would undoubtedly be desirable. It is only intended here to suggest this protective measure for the State as the one most easily defended, the one most readily carried through the legislature.

The adoption of such a plan would have a most salutary effect upon the engineering profession in general. If the methods of putting names of competent engineers on the lists for the various grades of appointments are as good as they should be the certificate of eligibility will be the best evidence an engineer can have of his technical standing, and the state's examination will be taken by many who do not expect to seek public employment, simply that they may have the certificates of attainment. Employers will soon come to demand such certificates as evidence of competence. Such voluntary examinations as have been devised by organizations of engineers in England show that this will be the effect. The only problem is to secure a competent examining board with a reasonable set of instructions by the legislature.

CO-OPERATIVE FRANCHISES FOR MUNICIPAL PUBLIC SERVICE CORPORATIONS.

The attempts to secure co-operative franchises for municipal public service corporations are becoming numerous enough to be noticeable. Unfortunately they are up to this time unsuccessful attempts and we have as yet no practical trial to show what their success may be.

The first is one presented by the water company at Lake Forest, Ill., based on suggestions made by the mayor of Lake Forest, which were elaborated and added to by the attorney and the engineer of the water company. Mr. J. W. Alvord, in a paper on "A Co-Operative Water Works Franchise," before the American Water Works Association at its New Orleans convention, gives the terms of the proposed ordinance. The reason he gives for the failure of the council to pass the ordinance, although the city officials suggested its principal terms, is that some increase in water rates would doubtless be made by the appraisers and the council has not seen fit to initiate a proceeding which would have this result.

The second proposed ordinance is one, the terms for which were suggested to the city of Champaign, Ill., also for a water company, by Dabney H. Maury of Peoria. Mr. Maury presented these recommendations in a paper before the Indiana Sanitary and Water Supply Association a year or more ago, which paper is printed in MUNICIPAL ENGINEERING, vol. xxxvi, p. 247, to which reference may be made for the details of the new terms proposed. This proposition seems to have dropped out of consideration without arriving at any definite stage of discussion between council and company.

The third proposed ordinance is one presented by the Commercial Club of Crawfordsville, Ind., to the city council, together with the agreement and bond of one of the companies to accept the ordinance if passed; the desire being to unite the two telephonic services of the town and their long-distance connections into one. This ordinance is given in whole or in part in papers presented by Charles Carroll Brown of Indianapolis to the American Society of Municipal Improvements and to the Indiana Engineering Society. It was rejected by the city council because that body, according to statements of its members, feared it would not produce the desired consolidation.

It is thus seen that, as shown by the record, the principal difficulty in the way of the adoption of this modern form franchise, which substitutes definite, equitable, adjustable terms for the former indefinite franchises, is in the city councils and not in the companies. What this means it is difficult to say. Each of the councils named has had the benefit of expert legal and engineering advice, the ordinances having been actually prepared by such men, in one case, in the employ of the company, in the second of the city, and in the third of a disinterested committee of the leading business men. If the city officials could place their confidence in anyone it would seem that they could accept the judgments thus formed and presented to them.

Definite reasonable returns on the capital actually invested in the plants were provided for, and the methods of determining what the rates should be to produce these returns were minutely detailed, with ample provision of checks and publicity as preventives of dishonesty and injustice to either party. In two cases at least the rates were none too high, and the knowledge of this fact probably prevented action by one council, as above stated, and possibly by the other, although no such reason for the rejection of the ordinance was given. It would not be fair in any of these cases to suspect any ulterior motive, although such suspicion may arise in the minds of those who do not know the circumstances in the various cases. The most obvious explanation to one who has had experience with city councils, especially in the smaller cities, is that the proposals are so new in form that the inertia of council-manic ignorance was greater than the influences brought to bear in favor of the change. In at least one case this inertia was aided by the active opposition of a few persons whose interests would be affected by the passage of the proposed ordinance.

In the state public service commission lies the logical control of municipal public service corporations under both public and private ownership, but neither Illinois nor Indiana has such a commission nor any prospect of the early establishment of one. The co-operative franchise is therefore simply a temporary expedient for use where it can be secured until the better system is adopted. The machinery required for carrying out the purposes of the ordinance requires expert handling to secure good results and the small city has such experts at home only by the merest chance, and is likely to object to the expense of bringing them in

from outside. The state commission, on the other hand, has business enough to warrant the employment of the highest class of expert assistants and can keep them busy all the time. The best possible results can therefore be obtained at a low percentage of cost on the interests involved.

The Illinois legislature has attempted to supply the lack of a state commission by tacking the duties of such a commission on a similar body for each city in its bill providing for a commission form of government for its cities, but this application of force to the control of the public service corporations is on a far different basis from the proposed co-operative franchise and has all its difficulties and dangers from ignorance of the operators. Fortunately the bill is not liable to pass both houses of the legislature or the Governor.

Professor M. H. Robinson, in a paper before the Illinois Sanitary and Water Supply Association, suggests some terms for a state public service commission law which would insert the profit-sharing co-operation of city and company under state regulation.

STANDARD PAVING SPECIFICATIONS.

Some criticisms of the specifications adopted by the organization for standardizing paving specifications assert that they are of variable quality and there have been numerous expressions of opinion about them.

So far as MUNICIPAL ENGINEERING is informed there have been but few adverse criticisms of the asphalt specifications. This should be the case, because they were prepared by a well-informed committee, with an unbiased expert in its membership, after full consultation with all the commercial asphalt chemists who could be reached.

The criticism of the brick specification is regarding its incompleteness. The method of laying a brick pavement is given in full detail, and as the specification prepared by the National Paving Brick Manufacturers' Association was adopted, experience has demonstrated that the best results attainable will be secured. The committee making the report did well to cut the specification for the brick to a minimum and call it temporary, for the N. P. B. M. A. is now engaged in making experiments which will give fuller knowledge of how to determine the qualities of bricks, and thus make it possible to devise a more accurate and more definite specification than has heretofore been possible.

There has been the most criticism of the wooden block specification, particularly of the specification for the preservative oil, and one chemist has gone so far as to say that the specification is an entire departure from former practice, and that former results may be no criterion by which to judge the future sufficiency of the preservative method. The collection of some of the specifications in use, which will be found in this month's "Question Department" indicates, however, that this departure is not so sudden nor so complete. Indeed, the specifications divide themselves into two classes, one including those in use for timber preservation generally, which is quite different from the newly adopted specification, and the other those in use by cities for treating paving blocks, which has many points in common with the new specification and from which it is not so radical a departure. It will be noted that several chemists consider high specific gravity of creosote oil suspicious and this is one of the principal points of criticism of the new specifications, but it will be noted also that this is not peculiar to the new specifications, but has been in use for several years. The city of Indianapolis in its new specifications has not followed the new specification for creosote oils, and the result is shown in the comparative collection of specifications referred to. The reasons for the differences in the two classes of specifications are also shown in the same article.

The specifications for the new pavements, concrete, bituminous macadam, oil and tar treated roads, were all presented as tentative, and the organization was continued to consider further the pavements which are now in a stage of further development.

THE QUESTION DEPARTMENT

Specifications for Concrete Dam.

Will you kindly advise me where I can get a good set of specifications for a concrete dam?

R. A. W., Batavia, N. Y.

Subjoined are the specifications for the East Park dam on Little Stony Creek, in the Orland project of the U. S. Reclamation Service, near Stonyford, Colusa Co., Cal. Our readers are invited to send other specifications for this and other kinds of concrete dam work.

The general conditions are omitted and the specifications begin with those for the dam proper.

38. The Requirement.—It is required that there be constructed and completed in accordance with these specifications and the drawings hereinbelow listed a concrete masonry dam of the gravity type with appurtenant structures.

39. List of Drawings.—General maps, plan, section and elevations of dam, section and details of dam, details of outlet works, plan and details of spillway, typical section and plans of dikes.

40. General Information.—The elevation of low water at the dam site is assumed at 100 and is indicated by a bench mark that may be seen at the dam site. The location of borings made to determine the depth to bedrock and the character of the materials encountered as indicated by the borings are shown on drawing. Dotted contour lines showing the surface of rock below the stream bed are assumed from the indications of the borings. Cores from bore holes will be shown, on application, to the bidder, who must make his own deductions regarding the depth to rock and character of the materials between bore holes.

41. Beginning and Completion of work.

42. Failure to Complete Work in Time Agreed Upon.—(Deductions, $25 a day.)

43. Progress Estimates and Payments.

44. Cement.—All cement will be furnished by the United States on board cars at the railroad station that, in the opinion of the engineer, is most convenient to the work. The contractor shall haul the cement from the railroad station to the work and shall be responsible for all demurrage charges. He shall furnish suitable warehouses for storing the cement until used, and will be held responsible for any loss or injury to cement after its delivery at the railroad station. If the cement is shipped in sacks the contractor will be held responsible for the return of the full number of sacks to the railroad station in as good condition as when received and will be charged for all lost or damaged sacks at the same rate as paid by the United States. The contractor shall give the engineer sixty days' notice in writing as to when he will require cement and shall state definitely the amount in carload lots and approximately in barrels, that he will require. The cost of hauling and caring for cement shall be included in the unit prices bid for concrete.

CONCRETE.

46. Measurement and Payment.—The concrete required in connection with the work covered by these specifications will be measured to the neat lines shown on the plans or to those ordered by the engineer. The unit prices bid shall include the cost of furnishing all forms and all material except cement and permanent metal work and shall cover the handling and storing of cement and the furnishing of all labor.

47. Composition.—The concrete shall be composed of Portland cement, sand, gravel and water in proportions to be fixed by the engineer. The proportions shall be determined by measurement before mixing and will generally range between one part cement to seven parts of admixture and one part of cement to ten parts of admixture, the term admixture being understood to mean the sum of the volumes of the sand and gravel measured before mixing. Whenever the thickness of the concrete exceeds two feet, large sandstone blocks shall be embedded therein.

48. Sand and Gravel.—Sand and gravel for concrete will be obtained from natural deposits in the vicinity of the dam, carefully selected to comply with the specified requirements, and the material after being excavated shall be screened so as to produce three graded sizes, as follows: Material passing a two and one-half inch round hole and rejected by a one-inch round hole; material passing a one-inch hole and rejected by a one-quarter inch round hole; material passing a one-quarter inch round hole. All material rejected by a two and one-half inch hole shall be wasted. All this material shall be free from organic matter and each engineer will from time to time determine the proportion of each of the various sizes to be mixed into concrete, the object being to secure the densest possible mixture. In case there is a shortage in any one size, the same shall be promptly supplied by the contractor, and he shall not be entitled to payment for surplus of any graded size of the material.

49. Water.—Water for mixing concrete shall be free from organic matter, oil, grease or other like impurites and shall be otherwise reasonably clean. The amount of water to be added to the mixture will be determined from time to time by the engineer.

50. Mixing.—The mixing of concrete shall be performed by machinery in good order. The material shall remain in the mixer a sufficient length of time to produce thorough mixing. All mixing shall be done to the satisfaction of the engineer.

51. Sandstone Blocks.—There shall be embedded in all concrete having a thickness in excess of two feet as large a proportion of sandstone blocks between twenty and thirty-five per cent of the mass of concrete as is practicable in the

judgment of the engineer. The sandstone blocks shall be free from cracks and flaws, close-grained, hard and of a quality that does not weather. They shall be clean and thoroughly wet before being placed in the work and shall be roughly cubical in shape and form one cubic foot to one cubic yard in volume. The contractor shall provide a plant capable of handling with ease rocks up to one cubic yard in size.

52. Placing.—All rocks surfaces upon which concrete is to be laid shall be clean and thoroughly wet immediately before the concrete is to be deposited. Under no conditions shall concrete be laid in deep, moving or muddy water. The dropping of concrete from such heights or moving it over such distances as will cause separation of its constituents will be permitted only with special consent of the engineer, and in such cases the concrete must be thoroughly remixed before being placed. Concrete shall be used "wet" whenever practicable, and "dry" only when rendered necessary by circumstances. If laid "dry" the concrete shall be well tamped with heavy tamping bars until water flushes to the surface, and if laid "wet" it shall be worked with suitable spades, bars and forks so that porosity and rough surfaces shall be avoided. In concrete exceeding two feet in thickness, the contractor shall embed sandstone blocks as specified in Paragraph 51 and in accordance with the instructions of the engineer. The concrete shall be built as directed by the engineer in layers of from six to nine inches in depth, into which the blocks shall be sunk so as to receive solid bearings and avoid all cavities. The blocks shall be so placed in the work as to leave at least six inches of concrete between the smaller and twelve inches between the larger blocks. When a six-inch layer of the working surface of the dam cannot be completed during any one day, the unfinished end of such layer shall be formed in broken lines in strict accordance with the instructions of the engineer. Concrete laying will not be permitted when the atmospheric temperature drops below thirty degrees. No concrete shall be laid except in the presence of an inspector.

53. Joining Work.—In joining new work with old, the latter shall be thoroughly cleaned of dirt and loose material of every kind and thoroughly wet, and, if required, it shall be roughened before the new concrete is deposited. Where expansions joints occur the faces of the old concrete, after being cleaned dry, shall be given a heavy coat of crude oil satisfactory to the engineer, which shall have at least one day's drying before fresh concrete is laid against it. Compensation for this work, including the furnishing of oil, shall be included in the unit prices bid for concrete.

54. Initial Set.—All concrete that has acquired an initial set before being deposited will be rejected or shall be remixed, at the option of the engineer. If rejected, it shall be promptly removed from the work. The cost of the cement to the United States will in such cases be charged to the contractor and deducted from any amount otherwise due him.

55. Forms.—In constructing forms the ribs shall be of sufficient size and so spaced as to prevent springing. The lagging shall be not less than 1½ inches in thickness and shall be surfaced on one edge, and where concrete surfaces are to be exposed it shall be surfaced on one side. It shall be of uniform thickness and of selected material. The forms shall be skillfully framed and fastened to secure even surfaces and true shapes for the concrete. All forms shall be removed before completion of the work.

56. Finishing Concrete Surfaces.—Immediately after the removal of the forms rough surfaces and irregularities of exposed work shall be dressed down and all voids shall be neatly pointed with mortar. The top surfaces of concrete, where exposed, shall be floated to a true and smooth surface before the concrete has attained its initial set.

57. Sprinkling.—All concrete shall be kept wet for at least ten days after placing.

58. Setting Iron and Steel.—All steel reinforcement, gates, anchor bars, pipes and other metal fixtures shown on the drawingsc or otherwise required, shall be carefully set in the exact position shown in drawings or indicated by the engineer, for as specified in Paragraph 45.

59. Description.—Under the heading Main Dam is included all work necessary for the construction of the concrete masonry dam with outlet works on Little Stony Creek. Gravel and sand for the concrete may be obtained from gravel bars immediately below the dam, so far as suitable material can be obtained from this source; also from gravel bars about one mile upstream from the dam. Sandstone rock may be obtained from a quarry about one mile from the dam.

60. Measurement and Classification of Excavation.—All material required to be excavated in exposing and preparing the foundation for the dam and outlet works will be measured in excavation and classified for payment as follows:

Class 1. All material overlying bedrock.

Class 2. All bedrock below elevation 100.

Class 3. All bedrock above elevation 100.

61. Control and Diversion of Stream.—Little Stony Creek drains an area of 102 square miles. The surface flow during the time that measurements have been made is shown in the following table (omitted).

There is to be provided an opening 24 inches in diameter through the dam at creek-bed elevation as shown in drawings. Until the dam is raised to the elevation of the main outlet, all water that cannot pass through this 24-inch opening must be stored or allowed to flow over the dam. After the dam is raised above the elevation of the main outlet, the latter will also become available for passing water, limited, however, to the passage of 200 second-feet and subject to the approval of the engineer. The contractor shall repair without cost to the United States, except for required cement, all damage done to the work prior to its final completion. Payment for the work of diversion, control and pumping shall be included in the unit prices bid for the various items in the schedule.

62. Excavation for Foundation.—All material in the creek bed overlying the foundation of the dam shall be excavated to bedrock. The excavated material shall be deposited on the downstream side of the excavation and in such manner as not to interfere with the construction and subsequent operation of the works. It shall be at the option of the contractor to utilize as much of this material in construction as shall be deemed suitable by the engineer. Payment for this work will be made at the unit price bid for Item 1, and the quantity upon which payment will be based shall be the mass lying vertically above the neat lines of the

base of the dam. All seamy and rotten rock shall be excavated and removed. A trench along the water toe of the dam and necessary steps for proper footings for the masonry, as required by the engineer, shall be excavated. Excavation shall be done by means of picks, gads, bars and other suitable tools, the use of explosives being prohibited. The work of excavating shall be so conducted as to prevent excavated material from coming in contact with freshly deposited concrete. The excavated material shall be so deposited on the downstream side of the dam as not to interfere with the work of construction and the subsequent operation of the completed structure. The surface of the foundation shall be thoroughly cleaned with brooms and water jets to the satisfaction of the engineer. Payment for the excavation and deposition of such rock will be made at the unit prices bid for Items 2 and 3.

63. Commencement of Masonry Work.—All seams in the foundation shall be thoroughly cleaned and grouted, and any springs of ground water that appear shall be controlled in a manner approved by the engineer. The excavation shall be kept free from water, and dry cement shall be scattered over the surface of the rock prior to depositing concrete. Payment for this work shall be included in the unit prices bid for Item 4.

64. Foundation Pit.—The elevation of the water in the foundation pit must be kept at all times under control, so that no water will be in contact with the concrete until it is at least forty-eight hours old and no pressure must be allowed against it until it is at least seven days old.

65. Progress of Work.—The dam shall be carried up as nearly level as practicable over its entire length and as a monolithic structure up to elevation 155. In case of any difference in elevation during construction, the work on the downstream face of the dam shall never be lower than that toward the upstream face. Above elevation 155 the work shall progress in alternate sections separated by expansion joints, which joints shall lie in vertical radial planes 20 feet apart, measured along the center line of the dam at the top, and which shall continue upward to the main top of the dam at elevation 187. The alternate sections shall make thorough junction with the dam below and may be built up to any height in advance of intermediate sections.

66. Masonry Above Elevation 187.—The parapet wall shall be built in alternate sections ten feet in length, the ends of which shall be coated with crude oil, after which the intervening sections shall be built in. Crude oil shall also be employed on the sides of the railing posts and at other points where shown on drawing, or as required by the engineer.

67. Resumption of Work After Flood Season.—In case the surface of the concrete upon resumption of work during the year 1910 shall ,in the engineer's opinion, be too smooth to secure proper bond with the new work, the surface of the work shall be roughened and dry cement shall be scattered over the old surface before new concrete is deposited, as may be required by the engineer.

68. Twenty-four Inch Outlet.—A 24-inch outlet shall be constructed near creek-bed elevation, and a standard gate and cast-iron pipes shall be placed in positon therein, and from the end of said pipe an opening shall be provided through the dam as shown in drawings, or as directed by the engineer. The cast-iron pipe, gate and appurtenances will be furnished by the United States, and the handling and placing thereof will be paid for as provided in Paragraph 45.

70. Main Outlet Works.—The main outlet works shall be built as shown on drawings. All concrete in the gate tower and in the walls of the conduit below the dam will be paid for at the unit price bid for concrete.

71. Gates.—All gates and appurtenances shall be set as shown on drawings, or as directed by the engineer. The entire operating gear shall be left in perfect and easy working condition. The handling and setting of the gates and appurtenances will be paid for as provided in Paragraph 45.

72. Anchor Bolts.—All anchor bolts shall be set as shown in drawing, or as directed by the engineer. They will be furnished by the United States and the handling and setting thereof will be paid for as provided in Paragraph 45.

SPILLWAY AND DIKES.

75. Preparation of Spillway Foundation.—At all points where concrete is to be deposited all earth overlying bedrock shall be removed. The material shall be wasted in the vicinity of the excavation and in accordance with instructions given by the enginer. Trenches and all seamy and rotten rock shall be excavated and the excavated material shall be deposited in accordance with instructions given by the engineer. The surface of the rock shall be thoroughly cleaned and wet to the satisfaction of the engineer before any concrete is deposited.

76. Spillway Masonry.—The masonry in the spillway shall consist of concrete with embedded sandstone blocks, as specified in paragraphs 47 to 58, and will be paid for at the unit price bid for Item 7. No concrete shall be deposited in the spillway during the period from April to September, inclusive.

77. Trenches for Dikes.

78. Dike embankments.

79. Pitching.

Cost of Street Cleaning.

The city of Eureka put in about 15,000 square yards of brick paving a year ago and is now confronted with the problem of keeping it clean. Please advise us whether for this amount it would be worth while to purchase a sweeping machine, or would it be more economical to do the work by hand? About what will the relative costs of hand and machine sweeping be?

RICHARD DICKINSON,
Mayor, Eureka, Ill.

It would doubtless be less expensive to clean this area of street by hand, unless a team used for some other purpose can be utilized for the short time necessary to sweep the street, or it is thought advisable to sweep the street every day. In that case the same man and team could be utilized for picking up the sweepings from the gutters and the man could put in any idle time in picking up horse droppings where teams are most numerous. The mile or less of street would thus be kept perfectly clean at the cost for apparatus of a sweeper, a wagon for removing sweepings and the necessary hand scraper and shovel for the gutter work and picking up droppings, and a cost for operation of one man and team. If the city owns the whole outfit the cost would be, say, $3 a day, including an allowance for new

brooms, repairs, etc. Or the estimate can be made on the cost of hiring a man with his team by the day and buying or filling two or three brooms during the season, and new scrapers and shovels each year. Names of makers of sweepers, scrapers, dump wagons, etc., will be found in the "Business Directory" printed in each number of MUNICIPAL ENGINEERING under the headings, "Dump Boxes," "Dump Carts," "Dump Wagons," "Street Cleaners' Carts," "Street Scrapers," "Sweepers," "Wheel Barrows."

It would require two men, each with hand scraper and broom and two-wheeled cart, to keep 15,000 square yards of pavement clean, and it would keep them busy unless the sweepings were carried away by someone else. The cost in this case for apparatus would be the two street cleaners' carts, the scrapers and brooms, and the cost for operation would be the wages of the two men, four to six hand street brooms a season and, say, two scrapers.

The maintenance and repair bills should be very small, so that the reative cost can be determined from the comparison of cost of man and team and of two men. The outfit for hand cleaning would not cost as much as that for machine cleaning.

In the March number of MUNICIPAL ENGINEERING, vol. xxxviii, p. 193, will be found some figures of cost of street cleaning.

Compensation for Street Railway Franchises.

We will shortly submit to the voters of this city a proposition to amend the street railway franchises, providing for the street railways to pay into the city treasury a certain percentage of their gross earnings for the privileges they enjoy from the use and occupancy of the streets.

As the corporations and their friends will naturally unite to fight us, I would appreciate any statistics or information that you may be able to send me that will assist in presenting arguments on the subject to the voters. I would like statistics and information concerning the cities that are now operating under such public utility regulations, showing the gross earnings of the corporations and the amount and percentage of revenue derived therefrom by the cities.

PERCIVAL E. WOODS,
Supt. Dept. Finance, Ways and Means,
San Diego, Cal.

The publications of the U. S. Census Department give the fullest information on this subject. The special report on "Street and Electric Railways, 1902," gives some information as to methods of regulating fares and compensation for franchises. Statement of the requirements in each city, taken from this report, will be found in MUNICIPAL ENGINEERING, vol. xxx, p. 276. In some cities the rates for fare are reduced as the profits of the business increase, in others payments to the city treasury are required which may be constant or may be increased by definite amounts at definite times, or may be a definite percentage of the gross receipts, which again may increase or decrease as time passes or as the total amount of gross receipts increases. There are also the regular taxes, which may be imposed without reference to compensation for franchise or reduction in fares, or may be included therein. The compensation may also take the form of car licenses. Thus all the common methods of raising revenue employed by a municipality are applied to street railway companies either singly or in any combination, and also the reduction in fares.

Car licenses are collected in many cities, particularly in the South. A few cities charge licenses by the length of car. Some charge for all cars owned and others on the average daily number in use. Some Pennsylvania cities charge per pole instead of per car, thus reducing the tendency of the operating company to keep down the number of cars.

Nearly all cities require the companies to pave between rails and tracks and for three-fourths to two feet outside. The companies are sometimes required to keep their tracks clean and even sprinkled or the city does the work and assesses against the company its share of the cost of the whole street. A few of the smaller towns require the company to furnish free street lights, especially at the streets crossing the street railroad lines.

The commonest form of compensation for franchise is a percentage of gross receipts. Most municipalities using this plan net less than 3 per cent. after the ordinary taxes are allowed for.

The U. S. Census Bureau's "Statistics of Cities Having a Population of over 30,000 for 1906" and for 1907 give the receipts from taxes, licenses and direct payments for public service privileges for many cities. An article on another page of this number of MUNICIPAL ENGINEERING, "Percentages of Receipts as Compensation for Street Railway Franchises," gives a collection of information on the particular question asked.

Cost Keeping for Engineers.

We should be very glad to have you advise us where we may secure a good book on a system of "cost keeping" for an engineering firm. We know of a number of good works of this kind on cost keeping for contractors and general work, but have been unable to find anything that meets the requirements for a firm doing a general engineering business. Thanking you for any favors in this regard, we are P. G. C., ——, S. D.

Can our readers refer us to such a book or article? A good book on the principles of cost keeping, such as Millener's "Cost Accounting" or possibly Gillette and Dana's "Cost Keeping and Management Engineering," or an article such as Moore's "Cost Keeping on Municipal Contract Work" in MUNICIPAL ENGINEERING, vol. xxxvi, p. 1, gives the principles upon which to base an accounting system. The details must be worked out for the particular business.

The first thing to determine is the amount of detail desired. This must be limited by the ability of subordinates to distribute their time and supplies used over the various items and by the cost of keeping the records. It is not difficult to devise a system of cost keeping which will be more expensive than is necessary, or that will have a cost out of all proportion to its usefulness. It is easiest to begin a system on broad lines with few items and then to differentiate these items as experience shows the desirability of such a course.

One with a strong tendency toward system can often work out a more satisfactory system in his own office than can be worked out by an expert in office systems who tries to make a machine which will from the beginning show all possible details and thus overloads his system and thereby throws it into disrepute.

Suggestions as such systems as may have been worked out by our readers are solicited for publication as aids to other engineers.

Specifications for Creosote Oil.

I am enclosing a portion of my wood block specifications pertaining to the oil with which the blocks are treated and will appreciate it very much if you will give me your opinion on the following points:

1. Will a minute trace of free carbon affect the quality of the oil, and will it interfere with the block being thoroughly permeated with the oil?
2. When the oil is dissolved in bensol will a small quantity of suspended matter affect the thorough penetration of the wood?
3. Would you advise a change in the specifications to allow a small quantity of free carbon and suspended matter when dissolved in bensol, or let the specifications remain as they are?
4. Is it possible to produce a heavy oil without a trace of carbon?

S., Chief Engineer.

It seems to me that the specifications for oil with which to treat creosoted wood paving blocks adopted at the Chicago convention of city paving officials make a wide departure from the former practice, and I would like to know how they really differ from previous standard specifications. SUBSCRIBER, ————, Ind.

Specifications for creosote oil have been changed frequently since the treated wood block paving industry began in this country some twelve or fifteen years ago.

Previous to that time the use of creosote was mainly as a preservative and oils were selected with this quality in view, permanence requiring also oils which would be as slightly volatile as possible and sometimes as nearly insoluble in water as possible. It was seldom required that the timber be filled full of the preservative and therefore the specifications regarding free carbon and other insoluble matter were rather to determine the quality of the oil than to take account of the treatment of the blocks with the oil.

But when the wooden block paving began it was soon found that the oil must not only be preservative of the wood, but it must be non-volatile and insoluble in water, and must fill the pores of the block completely in order to produce the full effect required for a perfect pavement. Free carbon cannot enter the pores of the wood except very imperfectly, and by stopping the pores may prevent the entrance of the oil. The same is true of any other insoluble matter and even of crude tar. Attempts have been made to prevent the solution of oil in water and its volatilization by closing the pores at least near the surface with some insoluble, non-volatile substance so that water and air cannot reach the oil within, even if it does not completely fill the pores within the block. These substances are difficult to force into the block and the proportion used has declined as experience has shown that a less quantity produces a better result. The latest specifications practically ignore these admixtures and depend mainly upon the oil to be injected. It is evidently more necessary to keep the proportion of free carbon, insoluble substances and tarry substances down in oils intended for treating paving blocks than in purely preservative treatments.

The above questions may perhaps be best answered, though not with perfect definition, by showing what the tendency has been in the changes of specifications which have taken place, and the following have been taken as probably typical cases, though they do not give all the variations nor all the steps in the variations in particular cases.

Circular 112 of the Forest Service, U. S. Department of Agriculture, gives standard methods of analysis and grading of creosotes for preservative purposes. The Bureau of Forestry in 1903 urged the general adoption of the following as indicating a high-grade oil by the best European standards:

1. The tar oil must be clear, i. e., there must be no substances in suspension as tested by a drop of oil on filter paper.
2. The specific gravity must be about 1.04 to 1.10 at 20 degrees C. The boiling points must be as follows: Up to 150 deg. C. nothing must come off; up to 200 C. not more than 10 per cent; up to 235 C. not more than 25 per cent., and up to 355 C. at least 90 per cent. must come off.
3. The oil must be soluble in benzine or absolute alcohol.

Specific gravity of oils solid at 20 deg. C. should be taken at 2 degrees above their melting point and reduced to 20 deg. The presence of 0.5 per cent. of insoluble matter, which is probably free carbon, should not cause rejection of the oil.

More detailed specifications for various grades of oil are derived from the tables, diagrams and text in Circular No. 112.

An excellent paper by Capt. John C. Oakes, printed by the U. S. Engineer Bureau, discusses the whole question, quoting the above named circular and others, and gives the following specification:

Oil should be of the best English coal-tar creosote oil or its equal without admixture of other oils or substances not derived from the distillation of coal tar. The relative gravity at 60 deg. C. com-

pared to water at the same temperature should be not less than 1.04. It should contain not more than 3 per cent. water, the percentage to be compensated for in computing amount of oil to be injected; not more than 5 per cent. should distill below 210 deg. and not more than 25 per cent. below 235 deg. C., using methods of Circular 112. Not more than 5 per cent. tar acids should be allowed in oil.

Capt. Oakes recommends 60 deg. C. as temperature of specific gravity determination, but allows determinations at other temperatures, with change of 0.0008 per degree C., or 0.00044 per degree F., to reduce to the standard. An oil with specific gravity above 1.07 is considered suspicious, for unless it is almost wholly lacking in the low-boiling fractions it may have hard pitch or undistilled coal tar mixed with it.

The methods of analyzing creosote adopted by the American Railway Engineering and Maintenance of Way Association given in Bulletin No. 65 of the association (50 cents) have been made the standards for paving blocks also by the organization for standardizing paving specifications. This bulletin does not give specifications, simply methods of analysis and forms for specifications.

The Atchison, Topeka & Santa Fe R. R. uses the above form of specifications, fixes a range of specific gravity between 1.00 and 1.10 at 60 deg. F., requires the oil to be perfectly liquid at 100 deg. F. and to remain so on cooling down to 90 deg. F.; changes the boiling test to not more than 30 per cent. distilling over between 210 and 235 deg. C. and at least 90 per cent. below 355 C.

The Prussian state railway administration requires for treating railway ties a tar oil containing not more than 1 per cent. that boils below 125 deg. C. The boiling point of the whole must be between 150 and 400 C. and not more than 25 per cent. must become volatile below 235 C. At least 20 to 25 per cent. must be acids dissolving in caustic soda lye of 1.15 specific gravity. At 15 deg. C. the tar oil must be completely fluid and as free as possible from napthaline, so that when distilled in glass vessels in groups of 50 deg. each it shall give off not more than 5 per cent. of naphthaline. The specific gravity at 15 deg. C. must lie between 1.020 and 1.055.

It should be remembered that the above specifications pay no attention to the use to which the timber is put, while those which follow are prepared for application to paving blocks.

In 1909 J. N. Hazlehurst, C. E., presented a paper, which will be found in MUNICIPAL ENGINEERING, vol. xxxvii, p. 379, in which he states that he started with a specification of "a heavy creosote product with specific gravity not less than 1.12 at 68 deg. F., not more than 40 per cent. to distill below 600 deg. F., and the specific gravity of the residue to be not less than 1.15, the oil to be devoid of carbon and absolutely soluble in bensol. On account of objections by bidders he investigated the subject through chemists and engineers and seems to have concluded that oil of this description is monopolized, and quotes chemists to the effect that by the very nature of creosote oil the specifications cannot be filled to the letter, as the temperature of distillation will split some of the higher hydrocarbons, making more or less carbon deposit and more or less insolubility in bensol, or the oil will be mixed with tar, as much as 10 per cent. being frequently used, and the tar and some of the oil will not be dissolved in bensol. As a consequence Mr. Hazlehurst offers the following:

The oil shall be a pure coal tar product completely liquid at 68 deg. F., and showing no deposit at this temperature. Its specific gravity shall be at least 1.12 and the oil at 68 F. shall not contain an excess of 2 1-2 per cent. of matter insoluble in bensol. With the thermometer suspended above the oil not more than 40 per cent. shall distill below 600 deg. F.

The Wyckoff Pipe and Creosoting Company in 1908 published a specification which they considered to represent the best practice in this country and in Europe. It requires the creosote to be a dead oil of coal tar containing not more than 3 per cent. of water and only traces of acetic acid and acetates. Its specific gravity at 100 deg. F. (38 C.) to be between 1.03 and 1.10. To leave only a trace of residue on the filter paper when filtered between 60 and 77 deg. F. To contain about 25 per cent. of crystallizable naphthalene and at least 15 per cent. anthracene oils and at least 95 per cent. to be soluble in carbon bisulphide and in absolute alcohol.

The specification for treating blocks with creosote and resin used in 1900 provided for a mixture of 38 per cent. of dead oil of coal tar, 2 per cent. of formaldehyde, 60 per cent. of melted resin, the specific gravity of the resulting mixture at 300 deg. F. being 1.068, when it is perfectly fluid. In 1904 this had changed to 50 per cent. each of creosote and resin, and in 1906 to 75 per cent. creosote and 25 per cent. resin, according to New York practice.

S. Whinery in his "Specifications for Street Roadway Pavements" (50 cents), published in 1907, gives the following specification:

The oil used for preservative treatment, commercially known as creosote oil, shall be dead oil of coal tar without adulteration. Oil known to the trade as "wood creosote oil" will not be accepted. The dead oil of coal tar shall not contain more than 1.5 per cent. of water, nor more than 5 per cent. of tarry matter. Its specific gravity at 60 deg. F. shall not be below 1.02 nor above 1.07. Subjected to distillation, no part of it shall be volatile at a temperature of 300 deg. F., and it shall not lose by evaporation more than 20 per cent. in weight when maintained at a temperature of 400 deg. F. for 4 hours. With increased temperature it shall yield not

less than 45 per cent. nor more than 55 per cent. of naphthaline. The residue, after exposure in a shallow dish to a temperature of 650 deg. F. for 3 hours, shall not exceed 10 per cent. of the original weight. The oil, freed from water, shall be wholly soluble in carbon disulphide. Special preservative processes involving the use of resin, pitch or other substances admixed with creosote oil may be used, provided that the treated wood shall contain not less than 10 pounds of creosote oil per cubic foot of wood and provided further that the substances thus mixed with the creosote oil shall not, in the judgment of the engineer, be in themselves deleterious and shall not in any way neutralize the value and preservative properties of creosote oil.

Following are some city specifications, showing the variations in different cities and the variations in the same city at different times:

The Chicago specification prior to the convention above referred to required the creosote oil to be a pure coal tar product, free from any adulteration or containing no petroleum nor more than 5 per cent. of matter insoluble in benzine. Oil obtained or partly obtained from water gas tar or oil tar would not be accepted. The specific gravity to be at least 1.1 at 25 deg. C. Evaporation to be zero up to 150 deg. C., not more than 5 per cent. to 210 deg., not more than 15 per cent. to 235 deg., not more than 40 per cent. to 315 deg. C.

The Cincinnati specifications in 1909 provided the following:

The oil shall be a "heavy or dead oil of coal tar," which must be free from adulterations, and must be obtained wholly and entirely from coal tar, and must not contain any oil derived from water gas tar, oil gas tar or other tars. The specific gravity at 60 deg. F. (20 C.) shall not be less than 1.10. The oil shall be free from carbon and shall contain not more than 2.5 per cent. of matter in suspension. When distilled in a retort with the thermometer suspended not less than 1 inch above the oil it shall lose not more than 35 per cent. up to 315 deg. C.

Indianapolis specifications have been changed from time to time as the industry has developed. It will be remembered that this city began the use of modern wood block pavements first of any American city and the early specifications required no treatment or simple dipping. The 1904 specification was as follows:

The oil which has heretofore been designated as heavy creosote oil shall be understood to be an oil obtained from the distillation of coal tar. This heavy creosote oil shall be kreodone oil of a standard as shown by test heretofore made in the office of the city civil engineer and on file in said office, or a heavy creosote oil. Both said oils, whether kreodone oil other creosote oil, must comply with the following conditions:

1. It shall be completely liquid at a temperature of 70 deg. F. or 21 C. and exhibit no signs of any deposit or cooling down to a temperature of 65 F. or 18 C.
2. It shall yield a total of at least 6 per cent. of tar acids when tested in accordance with the instructions annexed.
3. It shall contain at least 50 per cent. of constituents that do not distill at 600 F. (316 C.) nor more than 60 per cent.; nor shall more than 10 per cent. distill below 400 F. when tested in accordance with instructions annexed. It shall have a specific gravity of 1.040 to 1.075, water being 1.
5. The creosote oil shall contain not less than 15 per cent. of naphthalene nor more than 25 per cent. when tested in accordance with the instructions annexed.
6. The residue from distillation of 100 c. c. of the oil shall not have more than 10 per cent. of carbonaceous or bituminous matter when tested in accordance with the instructions annexed, and upon cooling shall show authracene crystals.

The specifications of 1906 require that the "paving oil" shall be "a heavy creosote product," with specific gravity of 1.12 at 68 deg. F.; reduce the distillation product to not more than 35 per cent. passing over at 600 deg. F., with no other requirement except that the specific gravity of the residue at 600 F. shall not be less than 1.15; and add the provision that the oil must be free from free carbon, absolutely soluble in bensol so that it will readily penetrate the wood.

The specifications for 1910 do not follow those adopted at the Chicago convention for standardizing specifications. They are as follows:

The creosote shall be derived from the distillation of pure coal tar and shall be free from any adulteration whatever or any admixture of undistilled tar. It shall be free from insoluble or suspended matter, and shall contain not more than 3 per cent. of water by weight, and shall have a specific gravity at 60 deg. C. of not less than 1.04. The creosote shall have the following fractions: Up to 205 deg. C. not more than 5 per cent. Up to 235 deg. C. not more than 40 per cent. nor less than 5 per cent. Up to 250 deg. C. not more than 50 per cent., nor less than 15 per cent. Up to 295 deg. C. not more than 65 per cent., nor less than 30 per cent. At 355 deg. C. the residue must be soft.

The Mobile, Ala., specification for 1909 is the same as the Indianapolis specification of 1906 above. That for 1910 has been changed.

In Brooklyn prior to 1906 the specifications provided for a mixture of 50 per cent. creosote and 50 percent. resin, requiring treated blocks to be of certain quality rather than the materials with which they were treated. In 1906 the specifications were changed requiring an antiseptic and waterproof mixture of 75 per cent. creosote or heavy oil of coal tar and 25 per cent. resin. The creosote oil was required to have a specific gravity not less than 1.12 at 68 deg. F. (20 C.), to lose not more than 35 per cent. up to 315 deg. C. and not more than 50 per cent. up to 370 deg.; to be free from adulteration, not mixed with or contain any foreign material. Oil completely extracted from fine turnings from a treated block with ether or carbon bisulphide was required to be distilled, the part coming off below 120 deg. C. to be collected separately and the oil obtained by distilling

up to 370 deg. to fill the above specification.

Boston required creosote oil to have a specific gravity of 1.12, and Minneapolis of 1.09.

A Manhattan specification of 1909 requires the specific gravity to be 1.12 at 38 deg. C. and the distillate between 255 and 315 deg. C. to have a specific gravity of 1.02 at 60 deg. C., the oil to lose not more than 35 per cent. up to 315 deg.

The full specifications adopted by the Organization for Standardizing Paving Specifications in February, 1910, will be found in MUNICIPAL ENGINEERING, vol. xxxviii, p. 247. In brief they require specific gravity at least 1.10 at 38 deg. C.; not more than 3 per cent. insoluble with bensol and chloroform, not to exceed 2 per cent. distillate up to 150 deg. C. and 35 per cent. up to 315 C.

. It will be noted that all the above specifications except those of cities, when reduced to the temperature of 38 deg. C. to compare with the last one, give a minimum specific gravity of 1.00 to 1.06 and a maximum of 1.05 to 1.10, omitting the Prussian figures. It will also be noted that the city specifications, with one or two exceptions, fix the minimum at 1.085 to 1.12 and, again with but one or two exceptions, fix no maximum. The Manhattan specification also provides that the specific gravity of the distillate between 255 and 315 deg. C. shall be not less than 1.00 (when reduced to 38 deg. C.).

The requirements for specific gravity are given in the following table, one column reducing them to the standard of 38 deg. C. (100 deg. F.):

SPECIFICATIONS FOR SPECIFIC GRAVITY OF CREOSOTE OIL.

Authority	Sp. Gr. and Temp. in Specifications	Sp. Gr. at 38 deg. C.
Forest Service	1.04 to 1.10 at 20 C	1.025 to 1.085
Oakes	1.04 to 1.07 at 60 C	1.06 to 1.09
A. T. & S. F. Ry.	1.04 to 1.10 at 60 F	1.02 to 1.08
Prussian Rys.	1.02 to 1.055 at 15 C	1.00 to 1.035
Hazlehurst	1.12 at 68 F	1.105
Wyckoff	1.03 to 1.10 at 100 F	1.03 to 1.10
Whinery	1.02 to 1.07 at 60 F	1.00 to 1.05
Chicago	1.1 at 25 C	1.09
Cincinnati, 1909	1.1 at 20 C	1.085
Indianapolis, 1904	1.04 to 1.075	
Indianapolis, 1906	1.12 at 68 F	1.105
Indianapolis, 1910	1.04 at 60 C	1.057
Mobile, 1909	1.12 at 68 F	1.105
Brooklyn, 1906	1.12 at 20 C	1.105
Manhattan, 1909	1.12 at 38 C	1.12
Boston	1.12	
Minneapolis	1.09	
Org. for Stand. Pav. Spec.	1.10 at 38 C	1.10

There is great variation in the specifications for proportions of distillate at various temperatures.

Up to 150 deg. C. the Forest Service, Whinery and Chicago permit no distillate and the new specification not to exceed 2 per cent., the others making no requirement, and the Prussian railways 1 per cent. at 125 deg. C.

Up to 210 deg. C. the Forest Service permits 10 per cent. distillate at 200; Indianapolis, 1910, 10 per cent. at 205; 1904, 10 per cent.; Whinery, 20 per cent. at 205; Oakes and Chicago, 5 per cent. at 210.

Up to 235 deg. C. the Forest Service, Oakes and the Prussian railways permit 25 per cent. distillate; Chicago, 15 per cent., and Indianapolis, 1910, 5 to 40 per cent. The A., T. & S. F. Ry. requires 30 per cent. distillate between 210 and 235 deg. C.

Indianapolis in its new specification goes into greater detail, prescribing 15 to 50 per cent. of distillate at 250 deg. C. and 30 to 65 per cent. at 295.

Up to 315 deg. C. and 600 deg. F. Cincinnati, Indianapolis, 1906, Mobile, Brooklyn, Manhattan and the Standardized Paving Specification permit 35 per cent. distillate; Prussian Railways and Chicago, 40 per cent., and Indianapolis, 1904, 50 to 60 per cent.

At 355 deg. C. the Forest Service, A., T. & S. F. Ry. and Whinery (at 343) require at least 90 per cent. of distillate, while Brooklyn required not more than 50 per cent. at 370 deg. C.

These variations indicate the need for a standard specification, for a given oil will not fit them all, and what is of high class according to one specification will be promptly rejected by some other. The only specification which has any general acceptance is that restricting the distillate at 315 deg. or thereabouts to 35 or 40 per cent., eight of the fifteen specifications prescribing one or the other, and a ninth 50 to 60 per cent.

But few of the specifications have a provision about free carbon or suspended matter.

Cincinnati, Indianapolis, 1906, and Mobile have the requirement of no free carbon; Indianapolis, 1910, of no matter insoluble or in suspension; but Cincinnati allows not to exceed 2.5 per cent. of matter in suspension.

The others vary in percentage of insoluble, Whinery allowing 5 per cent. of

tarry matter, but requiring all to be soluble in carbon disulphide; the Forest Service, 0.5 per cent.; Hazlehurst, 2.5; the Organization for Standardizing Paving Specifications, 3; Wyckoff and Chicago, 5, and Indianapolis, 10 per cent. of insoluble matter. The others in this list do not mention suspended matter.

The solvents used are benzine or bensol, carbon disulphide, absolute alcohol and chloroform.

Most of the specifications provide that the oil shall be a coal tar product, the most specific that it shall be obtained from the distillation of coal tar, and some that it shall not be adulterated with any other material, or shall not be mixed with coal tar itself, and the proposed standard specification provides that it shall be a coal tar product, but leaves the matter open to the admixture of coal tar if the other specifications can be met.

Indianapolis has met these difficulties to some extent by reducing the specific gravity somewhat, increasing the definiteness of the distillation specification and definitely providing that there shall be no admixture of coal tar.

The Commission Form of Government and the Indianapolis Charter.

Our students are debating the commission firm of government pro and con. We have been informed that the city government of Indianapolis has some peculiarities worth studying in this connection. I shall be greatly obliged if you will point out to me some of the features which in theory and in experience have proven most noteworthy. F. W. M., ————, Tenn.

Several articles upon the various forms which the Indianapolis charter has taken in the twenty years since it was first passed will be found in MUNICIPAL ENGINEERING. The basis was laid in the first document and the changes have been made in details of application, and not always for the better.

The article on "Charter for Small City," in vol. xxiv, p. 26, outlines the provisions of a bill to extend the Indianapolis form of charter to the smaller cities of the State, thus giving the salient points and brief reference to their success in the larger cities of the State. On page 354 of the same volume is a discussion of "Business and Politics in City Administrations," which considers one of the most prominent features of the Indianapolis form of city government, its similarity to the form of government of a business corporation and its equal dependence upon the interest and competence of its stockholders, the voters. The difficulties in the application of the principle under American conditions are discussed in an editorial in vol. xxv, p. 85.

An editorial in vol. xxxiii, p. 100, states some of the defects in various forms of commission government, and makes a comparison with the Indiana form, especially with reference to the business responsibility of the city's officials and the possibility of keeping them up to it. On p. 244 will be found a reply to some comments on the preceding editorial by the daily press. This idea is more fully developed in an editorial in vol. xxxiv, p. 161.

The principal defect in the Indiana form of city government has been the retention of the party organizations in city elections. This is discussed in an editorial in vol. xxxiv, p. 355.

In an editorial on "Plans for City Government," in vol. xxxv, p. 169, are outlined some of the ideas regarding home rule in cities, but at the same time are presented some of the methods of control by experts in the employ of the State of both municipal and private corporations in their operation of technical matters in which their knowledge is, under present conditions, incomplete, or their intentions may not be strictly honorable.

"State Commissions and Municipal Departments," an article by a former city alderman, in vol. xxxv, p. 365, makes some interesting points.

Some account of legislation affecting municipalities is given in vol. xxxv, p. 377.

The success of "Cedar Rapids Under the Commission Plan" is described by one of the councilmen in vol. xxxvi, p. 17.

"The Municipal Business Manager," described in vol. xxxvi, p. 279, is connected with the new forms of government in an editorial on p. 309, which also notes the improvement in the Indianapolis plan of electing a few councilmen by the city at large instead of a larger number by wards. The editorials on the "Bureau of Municipal Research" and "Non-Partisan Municipal Elections," on pp. 375 and 376, suggest methods of still further improving the Indianapolis plan.

The editorial on "Self-Government of Cities," vol. xxxvii, p. 103, elaborates upon one of the points above mentioned with reference to Colorado cities.

"The Latest Commission Form of City Government" is an editorial in vol. xxxvii, p. 393, the title to which may possibly be considered incorrect, in which the new Boston and Indiana plans are compared as to their most prominent features, and some of the advantages of each over the other are suggested.

Some of the difficulties arising under the commission plan in at least one of its forms are shown in an article on "Memphis Under a City Commission," in vol. xxxviii, p. 27.

"Nominations for Office Under the Commission Plan of Municipal Government," in vol. xxxviii, p. 155, develops the idea that one of the principal reasons for the successes with the commission plan has been the non-partisan character of the elections, or at least of the nominations.

"The Illinois Bill for Commission Government," which is not likely to become a law, is described briefly in vol. xxxviii, p. 180, and the reasons are given for the expressed opinion that the plan will prob-

ably be successful in the smaller cities, but is more doubtful in those that are larger.

Information About Sewage Disposal.

I am making a special study of sewage disposal. I will be pleased if you will send me a list of recent publications on the subject, also the numbers of your publication containing articles on sewage works.
R. R., Montreal, Que.

Good books on the subject by English writers are the second volume of Moore and Silcock's "Sanitary Engineering" ($14 for the two); Dibdin's "Purification of Sewage and Water ($6.50); Rideal's "Sewage" ($3.50); Barwise's "The Purification of Sewage" ($3.50); Dunbar and Calvert's "Principles of Sewage Treatment" ($4.50); Vernon-Harcourt's "Sanitary Engineering" ($4.50). A book on particular lines of American practice is Venable's "Sewage Treatment" ($3).

Following are some recent articles in MUNICIPAL ENGINEERING, and additional articles are listed in some of those named:

In vol. xxxviii, p. 177, "New British Sewage Disposal Works;" p. 192, "Information About American Patents on Sewage Purification Processes," giving a list of previous articles.

In vol. xxxvii, "The Sludge Disposal Problem in Sewage Purification," p. 19; "Status of Sewage Disposal in America," p. 80; "Sewage Disposal Plants and Stream Pollution," p. 119; "Joint Action of Cities in Abating Stream Pollution," p. 189; "Information About the Septic Tank," p. 253, giving references to previous articles and lists of articles; "Disinfection of Sewage and Sewage Effluents," p. 365. These articles can be supplied at 25 cents for each number.

Cost of Engineering for Municipal Improvement Project.

I am desirous of obtaining from you some information as to what would be a reasonable and customary charge, based upon a percentage of the total cost of the work as paid to the contractor, for doing all the engineering in connection with the improvement of a city street, the total cost of the work to be approximately $60,000.

The work in question consists of regrading, paving with either vitrified bricks or creosoted wood blocks, together with some granite block paving, all on a concrete base, on nine (9) different streets.

The grades on all of the streets have to be revised and readjusted, many of the concrete sidewalks have to be rebuilt to conform to the new grades, and 5,000 feet of new concrete curbs have to be constructed.

The work to be done by the engineer, for which I desire to know what would be a proper percentage to charge, includes the preliminary plans and estimates, the preparing of the specifications and contract, the subsequent detailed plans and all the necessary engineering superintendence during the execution of the work by the contractor. P., ——, Pa.

One formulated schedule would charge 5.1 per cent. for work costing from $50,000 to $100,000. This is divided into a half dozen items, which may be grouped into two for the purposes of this inquiry, completion of plans and specifications, 2.3 per cent and engineering superintendence and inspection of construction 2.8 per cent. The first figure may be divided into three parts, preliminaries, plans and specification, and details, and say one-half applied to the second and one-fourth to each of the others, but these proportions should be varied to suit the local circumstances. The figure for supervision of construction may also be divided into charges for the engineer and for the inspectors, say two-thirds to the former and one-third to the later, but as actually worked out in the field this division would depend upon the manner in which the work was done. If carried on at one point only and supervised by the engineer himself, there would be no inspection cost, but if carried on at many different places at the same time, with the engineer as supervisor of all the inspectors as well as the progress of the work, the proportion for inspectors might easily over-run the one-third allotted. The work would be completed in less time and the engineer's resulting per diem might be much greater than if he were the only inspector on a slowly moving job.

One important point is the possibility of delay in the work so that it will unduly interfere with the engineer's employment in other directions. Under such circumstances the actual cost of supervision might easily exceed the 2.8 per cent.

This subject is considered in MUNICIPAL ENGINEERING, vol. xi, pp. 47, 104; vol. xiii, pp. 91, 197, (where the schedule of charges referred to is given in full) 226, 302; vol. xv, p. 41; vol. xvi, pp. 1, 97, 193; vol. xxxv, p. 181, regarding fees for street paving engineering; vol. xxxviii, p. 268.

Will our readers suggest something out of their own experience? It has been difficult for engineers to get together on this matter of charges for their services, and discussion of the subject in a reasonable way will help toward the formulation of standards or the acceptance of those already formulated.

Information About Municipal and Private Ownership of Town, Water and Light Plants.

Our town council is considering the proposition of installing a water plant with probably an electric plant in connection. The council desires now to obtain the latest and most correct data and opinions on the question of municipal versus private ownership, and to this end has instructed me to purchase at least one book containing such information. Noting that you have recommended to various inquirers books on their various difficulties, I have decided to ask you to recommend and send a book, which will give a fair statement of the arguments pro and con on the subject of municipal ownership with especial reference to water

plants or light-and-water plants. There will be no objection to conclusions in the book, provided it gives a fair presentation of the two sides. We want a book involving the latest ideas and facts.

TOWN CLERK.

The only books going into detail in the comparison of the results of municipal and private ownership of public service industries are the three large volumes of the report on this subject made by a committee of the National Civic Federation, which can probably be obtained of that organization, 281 Fourth avenue, New York City.

As regards detailed information, the volumes of MUNICIPAL ENGINEERING are probably the fullest unbiased source of information. To begin with the current volume and give a few of the titles of articles in the last two volumes:

In vol. xxxviii: "The Water Works of Marion, Ind," public ownership, p. 4; "Municipal Ownership in Edmonton," p. 30; "Depreciation and Sinking Funds," p. 33; "Relative Cost of Municipal Work Done by Day Labor and by Contract," pp. 76, 194; "Books (and articles) on Electric Light and Gas Plants," p. 107; "Central Stations for Towns of 1,000 Population," p. 169; "Municipal Ownership," p. 175; "Municipal Electric Lighting in Boston," p. 179; "The Illinois Bill for Commission Government," p. 180; several articles on municipal and private water plants giving various detailed information, pp. 185, 186, 187; "Defects in Springfield Water Works," p. 199; "Handling Day Labor in Holyoke," p. 202; "The Combined Electric Light and Water Works of Thomasville, Ga.," p. 249.

In vol. xxxvii: "Cities Owning Water and Light Plants," giving also references to lists of articles on municipal water and light plants, p. 257; "Valuable Data Regarding Water Supplies," pp. 258, 330; "Municipal Gas Plant Experiences," p. 315; "Articles on Municipal Ownership," giving a number of previous articles, p. 324; 'C'ost of Electric Current," pp. 324, 397; "Water and Lighting Rates in Small Cities," p. 397. These are enough to show that each volume of MUNICIPAL ENGINEERING contains the best of the current discussions on this subject.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Cost of Sewer Construction and Cleaning in Boston.

From Metcalf and Eddy's report to the Boston Finance Commission, the accompanying figures of cost of sewer construction and catch basin cleaning are taken, showing the economy of the contract work under the conditions existing in that city at the time of the investigation.

Comparative Cost of Sewers Built by Day Labor and by Contract in Boston.—The costs of eight pairs of sewers, so selected as to be as nearly comparable with each other as possible, have been compiled in table 1. In each pair one sewer was built by day labor and one by contract. The pairs were selected by engineers employed by the city, who had direct personal knowledge of the conditions under which the work was done. After reducing the costs to equal terms as to size, depth and wages, it appears that in the case most favorable to day labor the cost of the sewer built by direct labor was about double that of the one built by contract, while in the case of the pair most favorable to the contract system the one built by day labor cost nearly four times as much as the one built by contract.

The Relative Cost of Cleaning Catch Basins by Day Labor and by Contract.—A study was made of the cost of cleaning catch basins by day labor and by contract. This study included the cost of cleaning nearly 9,000 catch basins, at a total expense of $54,000. The cost of doing this work by day labor averaged $6.39 per catch basin, or $2.47 per cubic yard of refuse removed from the basins, while that done by contract cost $4.15 per basin, or $1.46 per cubic yard.

Forms of Water Bills.

To the Editor of MUNICIPAL ENGINEERING:

Sir—As requested in the last number of MUNICIPAL ENGINEERING I am sending

herewith duplicates of bills actually sent out from this office December 1, 1909.

J. H. CHILD, Supt and Eng.
Board of Water Commissioners,
Wallingford, Conn.

The form for the flat rate bills is given below. The sheet is perforated so that the memorandum at the right is detached for office use when the bill is receipted. On the bill is stamped "5 per cent. discount will be allowed if payment is made on or before Dec. 23, 1909."

The form for meter bill is the same, the three blanks in the lower left hand corner being filled with the readings and the amount consumed. A slip giving the meter rates is endorsed in the bill. These rates are as follows:

city should from time to time be informed by the law department in written reports of the status of every case in which the city is a party. An office should be provided in the city hall in which the records of all the city cases should be preserved, and the law officials should report at said office at stated times daily, and there be accessible for consultation by any of the other city officials on the city business. —Mayor George Gonzales, Hoboken.

Are these suggestions of value to your city? Does your mayor or the head of your law department himself receive "written reports of the status of every case in which the city is a party"?

BUREAU OF MUNICIPAL RESEARCH,
New York.

Wallingford, Conn., December 1, 1909.

M. O. H. D. Fowler
369 Center Street,
Wallingford, Conn.

No.	Class	Annual Rate
1	Family	$5.00
1	Bath Tub	3.00
1	Water Closet	3.00
	Sprinkler	
	Horses	
	Cows	
1	Automobile	2.00
	Market	
	Miscellaneous	

To Wallingford Water Fund, Dr.

From June 1st, 1909, to Dec. 1st, 1909, $ 6.50
Abatement.
Received Payment,
Collector.

State of Meter, ____ } ____ Cubic ft.
Last Statement, ____ }

Office Hours: { June and December, Tuesdays, Thursdays and Saturdays, from 7 to 9 P. M. / Remaining Months, Thursdays, from 7 to 8 P. M.

M. O. H. D. Fowler $ 6.50
369 Center Street.

For the first 15,000 cubic feet of water used within the period of six months, the sum of

		$1.50	per M.
Next	10,000 feet	1.25	" "
"	15,000 feet	1.00	" "
"	20,000 feet	.90	" "
"	40,000 feet	.85	" "
"	100,000 feet	.75	" "
"	100,000 feet	.65	" "
"	250,000 feet	.55	" "
"	250,000 feet	.45	" "
"	250,000 feet	.35	" "

Over this amount 25 cents per 1,000 feet.

Opposite are the forms of flat rate and meter bills in use at Sherbrooke, Ont., W. B. McCaw, Secretary of Water Department.

The opposite form of notice of meter bill in use in Olathe, Kan., is printed on a postal card, the treasurer's stub being semi-perforated so as to be easily detached.

Service Reports and Balance Sheets for City Law Departments.

The law department of this city (Hoboken) has been conducted in a very unsatisfactory manner. The mayor of the

Wheeling's Brick Streets Must Be Sprinkled, Not Flushed.

The following is a copy of an ordinance passed during the year 1909 in connection with the use of water in sprinkling or flushing streets in Wheeling, W. Va.

An Ordinance Requiring the Use of a Sprinkler in Watering the Streets Paved With Brick.

Section 1. Be it ordained by the Council of the City of Wheeling, That it shall be unlawful for any person to use a hose in sprinkling or throwing water upon the streets paved with brick in the city of Wheeling without having attached to the nozzle upon such hose, or otherwise attached to such hose, a sprinkler, so that the water passing through such hose shall be distributed upon the street instead of being thrown from the hose in one volume.

Section 2. Any person violating the provisions of this ordinance shall forfeit and pay to the city of Wheeling a fine of not less than one dollar nor more than five dollars, in the discretion of the police court of the city of Wheeling, and shall also pay the costs of the prosecution.

Water Bills are Payable on or before the 20th May, August, November and February.

M_____Street

WATER BILLS are payable three months in advance, on the first days of Feb., May, Aug. and Nov., and must be paid by the 20th, at the CITY OFFICE, Brooks' Block, Opposite Post Office.

To the Sherbrooke Water Works, Dr.

☞ Persons vacating premises must give notice at the Water Works Office, as they are held responsible till such notice is given.

For Three Months Water Supply from Feb. 1st to May 1st, 1910 $_____

Make Cheques Payable to "City Water Department." **Arrears $_____**

If Bill is not paid in Twenty Days after presentation, the supply of Water will be cut off and will not be turned on again except upon payment of 50 cents, charges for shutting off and turning on the Water, in addition to amount of Bill.

Keep your Taps and Fixtures tight. *Water will be cut off if found leaking.*

Make Cheques Payable to "City Water Department."

M_____

To The City of Sherbrooke Water Department, Dr.

For Water Supply BY METER, Three Months ending

State of Meter . . . . . .

" " Last Settlement . . . . . .

Consumption . . . . . Cubic Feet

Equal to . . . . Gallons @ . cts. per 1,000 gallons

Rent of Meter. . . . . .

THIS BILL MUST BE PAID WITHIN TEN DAYS

This Card Must be Presented when Paying Bill.

Office of

ASSESSOR OF WATER RATES

CITY COUNCIL ROOMS

Olathe, Ks. .....

DEAR SIR:

Your last meter reading was. . . . . .

Previous meter reading was. . . . . .

Cubic feet consumed . . . . . .

.....Gallons at ..... per thousand amounts to $.....

This amount is due and payable at **City Treasurer's Office at Olathe State Bank,** from 1st to 10th, inclusive. No bill will be sent you. Receipt will be mailed when check for the above amount reaches the treasurer's office.

Respectfully,
L. R. SYKES, Assessor.

N. B.—City Ordinance requires payment of water bill on or before the 10th of each month. If not paid by the 10th water will be cut off without further notice.

Name

Paid

Ent.

$

TREASURER'S STUB

Floods in the Seine and the Ohio.

At the regular monthly meeting of the Engineers' Society of Western Pennsylvania, held March 15, President E. K. Morse appointed a committee to report on the question of raising the bridges over the Allegheny river at Pittsburg.

The importance of the questions involved, both engineering and financial, may be realized from the fact that there are eight bridges affected, over a river averaging 1,000 feet in width, the majority of which would be replaced in toto.

A paper on "The Floods in the River Seine" was read by Thos. P. Roberts of the U. S. Engineer's Office, Pittsburg. The author pointed out the peculiar soil conditions in the Seine basin, tending usually to restrain floods, but occasionally tending to prolong and increase the volume of their discharge. He made very interesting deductions from the following table:

Rivers.	Area of Basin, Sq. Mi.	Cubic Feet per Second.			Discharge Sec. Ft. per Sq. Mi. of Water Shed.		
		Approx. High Water.	Usual Low Water.	Extreme Low Water.	High Water.	Usual Low Water.	Extr'me Low Water.
Seine above Paris.....	15,000	60,000	2,640	1,200	4.00	0.176	0.080
Monongahela above Pittsburgh	7,391	160,000	400	175	21.65	0.054	0.024
Ohio at Pittsburgh.....	18,644	350,000	2,500	1,400	18.77	0.134	0.075

Note—In March, 1907, the Monongahela reached a discharge of 230,000 cubic feet, and the Ohio at Pittsburg 430,000 cubic feet per second. Doubtless during the late Paris flood the Seine at Paris reached or exceeded a discharge of 100,000 cubic feet per second.

Mr. Roberts referred to the very permeable nature of the soil in the Seine basin, three-quarters of its area being chalk, which gives rise to countless springs, and pointed out that these conditions, together with the Marne and other "equable" tributaries of the Seine, are capable in the aggregate of keeping up a long protracted medium flood stage at Paris, which, in 1876, lasted fifty-five days, owing to the very slight slope of the Seine below Paris, preventing a rapid carrying away of the water.

The author pointed out that owing to these conditions there arises at long intervals possibility of serious disasters in the Siene valley, which is unusually level.

During these weeks of high water to which the chalk country may furnish a large and persistent volume, a second rain storm may traverse the Yvonne, Neivre and Cote d' Or country, the bad third of the Seine basin, which is an elevated wooded region with extensive exposures of limestone, where, in places, rain water rapidly sinks to reappear in notably large springs. This local rainfall may not be very great, but it furnishes a sudden and sufficient increment on top of the medium flood to bring about gravely serious conditions.

Referring to suggestions made for governing flood conditions in France, by means of reservoirs, the author pointed out that nature is now illustrating at Paris one of the possible mishaps attending the use of reservoirs, as the chalk and gravel beds forming splendid reservoirs are letting out too much water which can not be controlled, for it is probably the case that, owing to the nature of the soil and topography, few sites can be found for large artificial reservoirs.

The matter of forestation was commented on, as were the projects looking to the enlargement and shortening of the Seine from Paris to the sea.

Model Form for Report of Water Works Department.

The waterworks department of Sherbrooke, Ont., W. B. McCaw, secretary, sends its financial statement for 1909, with the forms of bills which are reproduced on another page. There is also included a similar statement of the city gas and electric department. The waterworks statement is reproduced herwith. The statement of the department is similar in form, but is not so fully detailed. On account of lack of space, some of the items are condensed. The financial statement is as follows:

EXPENSES.

Interest		$12,487.50
Genral maintenance and repairs		3,362.28
General expenses (stationery), advertising, postage, etc.		663.15
Maintenance and repair pumps.		647.73
Wages		5,880.25
Annual sinking fund	$6,250.00	
Interest earned on sinking fund	1,099.44	
		7,349.44
Interest earned and deposited to special sinking fund		398.81
Depreciation		4,000.00
Net profit per year		2,085.64
Total		$66,874.80

RECEIPTS.

Water sold	$35,208.09
Material sold	71.23
Interest earned on sinking fund.	1,099.44
Interest earned on special fund	398.81
Interest earned on current deposit	97.23
Total	$36,874.80

The balance sheet is as follows:

Assets—Value of water system, December 15, 1908		$313,250.87
Additions during 1909 in the following items: Wheel, pipe, labor, meters, wages at dam, lumber, general expenses at power, boarding house, wages on pipe line, cement, new pump, valves, services, concrete, new pump house, road, land, heating plant, making a total of		33,038.53
Value December 15, 1909, $346,289,40; less deprecation, $4,000		342,289.40
Special sinking fund		9,273.40
General sinking fund		49,820.14
Bills due		6,227.33
Cash on hand		718.27
Materials on hand, pipe, $3,286.95; valves, $88		3,374.95
Services		358.62
Total		$512,061.86
Liabilities—Bonds of the city of Sherrooke		$392,500
General sinking fund		49,820.14
Special sinking fund		9,273.15
Loan from special sinking fund		6,000
Profit and loss		44,468.57
Total		$412,061.86

W. B. McCaw,
Secretary Water Department.

Traction Engine Hauling Wagons Out of Gravel Pit.

The accompanying photograph shows a novel method of taking gravel out of a deep pit, adopted by Hiram W. Reed, of Mishawaka, Ind. The pit is about 30 feet deep and the teams and empty Studebaker dump wagons are driven in at one side of the pit. The teams are then unhitched and driven out, leaving the wagons in the pit. When loaded they are pulled up the steep incline by a traction engine. Although the grade is so steep that it is difficult for the teams to get up the bank, the engine hauls the wagons out with ease though loaded with 1½ cubic yards of gravel.

HAULING STUDEBAKER DUMP WAGONS OUT OF GRAVEL PIT WITH TRACTION ENGINE.

Laboratory to Study Lake Michigan Pollution.

The establishment of a temporary laboratory at Hammond, Indiana, for the purpose of making tests and arriving at some scientific conclusion which will throw some light on how to solve the question of the pollution of the water of Lake Michigan by the sewers of Hammond, Gary, Whiting and East Chicago, is proposed by the food and drug laboratory of the State Board of Health of Indiana. At a recent meeting at the Chicago Board of Trade, in

Chicago, April 2, attended by the mayors of the Indiana cities interested, the question was discussed. The Indiana mayors agreed to take any reasonable steps to prevent pollution of the waters, but wished to know how it could best be done, and it is to answer this question that the state board will equip its temporary laboratory in Hammond.

Houston Park Commission.

A park commission has been created at Houston, Texas, to obtain for that city additional public parks to meet the demand of increasing population. The city has three public parks, two of which are yet to be equipped and beautified. Mayor Rice nominated William A. Wilson, George Hermann and Edwin B. Parker park commissioners, and council confirmed them.

Cost of Pole Line for 3-Phase System.

The following table of costs of three-phase system pole line per mile is taken from an article in the General Electric Review, and is compiled from actual figures submitted by operating companies in the localites indicated:

POLE-LINE COSTS PER MILE FOR 3-PHASE, 2,300 OR 6,600-VOLT.

No.	Item.	Omaha.	Kan. City.	Montana.	Minnesota.	Texas.	Tennessee.	Average.
50	30-foot poles...	$275.00	$287.50	$200.00	$200.00	$171.00	$180.00	$218.90
50	Pole hardware.	10.00	7.10	16.00	12.50	8.30	7.40	10.25
50	Cross-arms, 2-pin	17.50	7.25	11.50	15.00	17.00	16.00	14.00
150	Insulators	16.50	6.00	11.20	6.00	6.75	7.00	9.00
	Labor setting...	80.00	90.00	200.00	125.00	55.00	100.00	109.00
	Labor stringing wire	25.00	15.00	40.00	50.00	30.00	40.00	35.00
	Incidentals	25.00	41.00	50.00	30.00	10.00	20.00	30.00
	Totals	$449.00	$453.85	$528.70	$438.50	$297.05	$370.40	$426.15

These figures do not include painting and are exclusive of bookkeeping, overhead charges, and the like.

MUNICIPAL MATTERS IN COURT

Higher Courts—Damages for Taking Creek Water—Excessive Expenses—Sidewalk Merchandising Ordinance—Bitulithic Decisions

Decisions of the Higher Courts of Interest to Municipalities.

BY JOSEPH W. KENNEY, ATTORNEY, INDIANAPOLIS, IND.

Exemption of Municipal Corporations from Liability for Defects in Public Buildings.—In exempting a municipal corporation from liability for defects in its public buildings used for public or governmental purposes, or the negligence of its employes in their care, the law places them on the same footing with the state and counties thereof as to buildings owned and used by them in aid of government.—Schwalks, Adm'r. v. City of Louisville (Ky.) 122 S. W. 860.

Maintenance of Noxious Garbage Dump by City.—Liability on Theory of Nuisance.—A city acts in its individual, and not in its governmental capacity in disposing of garbage and is liable as an individual for creating and maintaining a nuisance in so doing, so that it would be liable to an adjoining owner, irrespective of negligence, where it established a garbage dump on its own land, the noxious odors from which made it uncomfortable and dangerous to reside on adjacent land.—City of Paris v. Jenkins (Tex. Civ. App.) 122 S. W. 411.

City Responsible for Funds Permitted to Be Paid to Officer Not Entitled to Receive Them.—Where a city contracting for the construction of a local improvement at the cost of property benefitted thereby permitted its comptroller to receive money in carrying out the work, the city must answer for his malfeasance, though under the charter public funds were not payable to him.—City of Seattle v. Stirrat, (Wash.) 104 P. 834.

City Not Liable for Negligence of Contractor in Work Collateral to Contract.—A municipal corporation is not liable for

the negligence of an independent contractor, if such negligence consists in some fault or omission wholly collateral to the performance of the work to be done, and not necessaryily involved in it.—Powell v. City of Waterloo, (Iowa) 123 N. W. 346.

Injury to Pedestrian from Obstruction in Street—City's Liability—Duty to Keep Streets Safe Can Not Be Delegated.—An independent contractor, constructing a cement extension to a sidewalk over a parkway to meet the curb, placed stones around it and a wire about two feet from the ground. A passer after dark, there being no lights, ran into the wire and was injured. *Held,* that the city was liable, since its duty to keep the walk in a safe condition by warning lights could not be delegated to an independent contractor.—id.

Appointment of Commissioner to Construct Bridge—Limitation of Authority.—Though the fiscal court can not delegate to an agent the discretion with which the law clothes it, it may, after determining the necessity therefor, appoint a commissioner, not a member of the court, to construct a bridge or contract for its construction, but it should in advance direct through its records the character of the bridge and its cost, and not allow the commissioner a round sum for the work, or leave to his judgment the character of the work and the cost, or allow him to obtain the money in advance for the doing of the work, either by a sale or assignment of the warrants therefor, or collecting from the county treasurer.—Milliken v. George L. Gillum & Son, (Ky.) 122 S. W. 151.

Construction of Defective Sewer System—City's Liability to Property Holders. A municipality constructing an unsuitable sewer system, without first duly adopting a plan, is liable for damage to property, because of the insufficiency of the system. * * * * Though a city is free from negligence in the adoption of plans for and in the construction of a sewer system, it is liable the same as in case of want of ordinary care in its installation, where the system proves not to be reasonably suitable, and it fails to remedy the deficiency within a reasonable time after notice thereof, either actual or constructive.—Hart v. City of Neillsville, (Wis.) 123 N. W. 125.

Right of City to Sell Water to Manufacturing Plant Located beyond its Boundaries.—Conferring the power on a city to sell water service to a manufacturing plant located beyond its boundaries, by Sp. Laws 1905 (P. 87 C. 6, Sec. 252), denying the city power to grant the use of any public utilities operated by it to anyone living beyond its limts, with an exception in favor of manufacturing plants, is not a grant of a thing of value to such a plant, which Const. Art. 3, Sec. 52 inhibits the legislature from authorizing a city to make.—Sturgeon v. City of Paris (Tex. Civ. App.), 122 S. W. 967.

City May Delegate Power to City Engineer to Locate Subdrains for Sewers.—Where a city providing for the construction of a sewer system, provided for subdrains to protect the system and determined the total length of the subdrains and the materials to be used, the fact that the city engineer had discretion to determine only where the subdrains should be placed did not render the proceedings void because delegating power to the city engineer to direct the manner and extent of laying the subdrains.—Hildreth v. City of Longmont (Colo.), 105 P. 107.

Acceptance of Tract with Plat Showing Extension of Street is a Dedication.—Where a plat of a tract partitioned, showing the extension of a street through the tract, was attached to the court's decree, and consented to by all parties at the time of the decree, and thereafter recognized by subsequent conveyances in conformity therewith, the parties' acts constitute a dedication of the tsreet.—Hunter v. City of Des Moines (Iowa), 123 N. W. 512.

Claims for Removing Refuse from Sewers Limited to Estimated Expense.—Greater New York Charter (Laws 1901, P. 50, C. 466) Sec. 149, requires the borough president to certify the estimated expense of executing contracts to the comptroller, and thereby limits the expenditures under a contract for removing refuse from the sewers of Brooklyn to the amount of such estimated expense, and where the amount of refuse exceeds the estimated quantity, the contractor has no claim against the city for its removal, though removed by him under a written order of the borough president.—Dondon Contracting Co. v. City of New York, 119 N. Y. S. 617.

Charter Provision Requiring Affidavit of Publicity of Ordinance.—A city charter provision that an ordinance after passage, shall not go into effect until recorded with an affidavit of publication in a designated book must be complied with before the ordinance can have any efficacy.—Hager v. Malton (W. Va.) C. 6, S. E. 13.

Motives of Council in Passage of Ordinance Can Not Be Inquired Into.—In passing an ordinance for a street improvement the council acts in a legislative capacity, so that the motives of its members can not be inquired into by a court for the purpose of determining the validity of the ordinance.—Gardner v. City of Bluffton (Ind.) 89 N. E. 853.

Charter Provision Limiting Ordinances to one object—Construction.—Seattle City Charter, Sec. 10, providing that every ordinance shall contain but one object, which shall be clearly expressed in its title, does not forbid the law-making body from passing an ordinance having a general object and bringing within its scope any number of subjects germane to the general subject, the provision being to prevent the union of disconnected matters, and an ordinance providing for the con-

demnation of lands for streets and parks, for an assessment of private property specially benefitted, to be made in the manner provided by law for raising the just and equitable proportion to be assessed upon private property, and providing that any part of the compensation, damages or costs that is not finally assessed against private property shall be paid from the general fund of the city was for the geenral object of condemning property for public use with details for carrying out the general object and was proper under the charter.—City of Seattle v. Sylvester Cowen Inv. Co. (Wash.) 104 P. 1121.

Operator of Subway Under Contract with City Exempt from Taxation.—Tax Law (Laws 1896, P. 796, C. 908, Sec. 2, as amended by Laws 1899 P. 1589, C. 17), making a special franchise of a railroad to construct or operate its line above, on or under public streets, real estate for the purpose of taxation, does not deprive the operator of a subway of the exemption from taxation declared by the rapid transit law first contained in the amendment by Laws 1894 (P. 1884, C. 752, Sec. 35, and substantially re-enacted by Laws 1900, P. 1360, C. 616, Sec. 35) providing that the operator of a subway shall be exempt from taxation in respect to his interest therein under the contract with the city for its operation and in respect to the rolling stock and other equipment.—Order (1908) 110 N. Y. S. 577, 126 App Div. 610, affirmed.—People v. State Bd. of Tax Com'rs., 89 N. E. 1109.

Water Company Failing to Provide Adequate Service—Receiver May Be Appointed.—When a water works company holding a municipal franchise had become insolvent, and had failed to provide wholesome water or sufficient pressure required by the franchise ordinance, and its water works system had been permitted to decay, the court was authorized, at the suit of the city, to forfeit a franchise and appoint a receiver.—Gainesville Water Co. v. City of Gainesville (Tex. Civ. App.), 122 S. W. 959.

Obstruction of Natural Drains By Railway Crossing.—The prohibition against the obstruction of natural drains having always been a part of the law, where a railroad acquires a right of way crossing natural drains, it did so sub modo; the condition being that it would not obstruct the drains.—Petit Anse Coteau Drainage Dist. v. Iberia & V. R. Co. (La.) 50 S. 512.

Condemnation of Property for Pipe Lines—Compensation.—The measure of compensation for the right to lay and maintain a pipe line along a railroad right of way across the owner's land is, in the absence of evidence that the strip has peculiar adaptability for a pipe line, the fair market value of the property at a fair and voluntary sale.—Color Oil & Gas Co. v. Franzel (Ky.), 122 S. W. 188.

Ordinance Declaring Brickyard a Nuisance—Held Void.—An ordinance declaring a brickyard, where bricks are burned within 1,200 feet of a residence, or a public school, or a city park a nuisance, unless permitted in the one case by the owner of the residence or in the other by the city, is void, for unreasonableness.—City and County of Denver v. Rogers, (Colo), 104 P. 1042.

When a Band Stand in the Street is a Nuisance.—A band stand in the street is a "continuing nuisance," where so long as it remains and is used for the purpose of its construction, it will interfere with merchants in their business, and hence injunction will lie against it after its completion.—Atterbury v. West (Mo. App.), 122 S. W. 1106.

City Liable for Injury at Street Fair.—A person injured while attending a street fair by being pushed from the steps leading from a platform, which steps led from the entrance to a tent to the open street, is entitled to recover from the municipality which has authorized the holding of such fair in such manner, notwithstanding the person so injured was not using the street in question for the purpose of travel.—(1908) Van Cleef v. City of Chicago, 144 Ill. App. 488, judgment affirmed (1909), 88 N. E. 815.

Damages for Taking of Creek Water by Cement Factory.

An opinion was filed recently by Vice-Chancellor Howell in a suit brought against the Edison Portland Cement Company by a property owner of Warren county, New Jersey. The plaintiff, who owns a grist-mill of 100 years standing, brought suit to enjoin the cement company from depriving her of the use of the water of the creek by the operation of the cement plant. In denying the allegations in the complainant's bill the cement company supplemented its answer with a cross-bill, praying that the complainant be enjoined from further proceeding with an action at law begun by her. The petition further asked that it be decreed, in case the complainant be entitled to a writ of injunction, what amount of compensation, if any, should be awarded to the complainant as just and equitable in lieu of the issuance of the writ of injunction prayed for by the plaintiff. Vice-Chancellor Howell, says in part:

The suit in this court is for an injunction to prevent the defendant (Edison Portland Cement Company) from future disturbance of the complainant's right. The common law action is an action for past infractions of the same right. What the defendant is now seeking to do is (1) to stay the suit for past damages; (2) to have it determined by this court whether the defendant is now or has been in the past guilty of a violation of any right of the complainant to flowage of water, and (3) if this court finds that there is such an infraction of the complainant's right that it will ascertain the extent and character thereof and award to the complainant such damages as she

may be entitled to, which damages the defendant stands ready to pay.

As a question of pleading, it may be said that the answer must always support the cross-bill. There is a variance between them in this case which must count strongly against the defendant. The answer denies all the injury complained of, while the theory of the cross-bill is that the defendant is committing a continuous trespass on the rights of the complainant, and that it desires to continue the same trespass indefinitely, and to pay therefor such sum as this court may assess.

If the defendant is guilty of the charge laid to its door, it is depriving the complainant of a valuable right in the waters of the creek, and this right is property to which the complainant is entitled.

Shortly then, the case under the cross-bill takes upon itself the aspect of an attempt to take private property for private uses upon such compensation being made as this court may award. This, of course, is not to be thought of. There is no proceeding known to the law by which one man can take the property of another for the private use of the taker, no matter what rate of compensation may be offered. This would be an interference with vested rights and can not be permitted.

It will be observed that there is no contract between these parties upon which the cross-bill can be predicated, nor is there any equity alleged by which the bill can be supported, except that the jurisdiction invoked may be exercised to prevent a multiplicity of suits. I do not understand that the doctrine touching the power of this court to interfere with a multiplicity of suits extends to the case made by the cross-bill. In short, what the defendant says is this:

"I am committing a most flagrant disturbance of the right of the defendant for which she is suing me. I desire to continue my trespass and to enjoin her suits for damages, not because I have any right in her land, but because she is bringing actions to defend the title to her property, which I want and am willing to pay for."

Laches was also set up in the cement company's answer, and concerning this the vice-chancellor says:

The fact that the complainant lay still and made no complaint for a period of two years, during which time the defendant took water from the stream, may have been sufficient laches to have justified the court in denying to her the provisisonal relief which he sought, but is she to be deprived of the title to her estate because she did not bring suit immediately upon the beginning of the trespass?

Excessive Expenses of Ashokan Reservoir Commissioners.

A decision handed down by Justice Chester, of the New York Supreme Court, allowed $2,000 to each member of three of the Ashokan reservoir condemnation commission, making a total of $18,000, with expenses aggregating over $3,400.

Objection to the bill rendered was made by the New York Corporation Counsel. Justice Chester, commenting on the city's objection to certain disbursements for automobiles used by the commissioners in visiting property sought to be condemned for the purpose of viewing it, says he agrees "that these charges are large, and that automobiles should not be employed against the objection of the city where it is possible to reach a point reasonably near the property by railroad; but early in these proceedings a custom grew up under which the assistants employed by the then Corporation Counsel made arrangements to provide commissioners with automobiles; after the Corporation Counsel's office had inaugurated this method for getting the commissioners to the property it is hardly fair to deny them the expense they have actually incurred in following that custom until after they have been notified that disbursements for automobiles in the future would be objected to."

Justice Chester criticised the custom of paying commissioners upon a per diem basis. "Under that system," he says, "there has been an evident disposition to prolong the work of the commissioners to an undue length. There is nothing in the law providing for compensation on that basis."

Sidewalk Merchandising Ordinance Valid.

In a decision rendered by Judge Snyder, of the Superior Court, at Washington, D. C., the ordinance regulating the display and sale of merchandise on the public streets of the city was held as both valid and reasonable.

The ordinance was recently passed by the city council and provides that no one shall be permitted to sell goods or solicit trade on the street, or display merchandise for sale except on shelves that shall not extend more than eighteen inches over the sidewalk. At the time the ordinance was passed it was generally admitted by the members of the city council that it was intended to apply to the one firm of S. A. Pierce & Co., shoe dealers, who utilized a considerable portion of the sidewalk in front of their store for the sale of goods and kept an employe on the outside to attend to the street sales.

Counsel for the Pierce firm contended that the ordinance was invalid because the title was defective and the measure itself was unreasonable and discriminating, and that it had been drafted and passed at the instance of the firm's competitors.

In overruling the motion to dismiss Judge Snyder announced that in his opinion the title was good and that he failed to see wherein the provisions of the measure were unreasonable and discriminating, in that they were intended to apply to all merchants.

Court Decisions on Bitulithic Pavement.

Three recent court decisions involving bitulithic pavement are of considerable interest.

One was in the New York Supreme Court, Richmond county, and refused an injunction against awarding a contract for bithulithic pavement on Fingerboard Road, and stated that fair and reasonable

opportunity for competition had been presented; that asphalt had designedly been omitted from the specifications, because a rougher pavement was needed on account of the steep grades; and because bitulithic where laid in similar localities had proved itself satisfactory and durable.

The second decision was by the New Jersey Supreme Court on a writ of certiorari to review a contract between Trenton and the United Paving Co. for paving Princeton avenue with bitulithic. The writ was denied on the ground that competitive bids could be received on a patented pavement as shown in Newark vs. Bonnell, 28 Vt. 424; Ryan v. Paterson, 37 Vr. 533, and Bye vs. Atlantic City, 44 Vr. 402, and that the choice of the Warren Brothers Company's formulae for the mixture was probably for the purpose of making it reasonably certain that the wearing surface furnished would be the genuine bitulithic article.

The third decision was by the Court of Common Pleas of Lucas County, Ohio, in the case of Speckert against the City of Toledo and others to restrain the letting of a contract to the Central Bitulithc Co. It refused the order on the ground that the failure to sign the bid until after it had been opened was immaterial since bond and affidavit were duly signed, being an oversight on the part of the agent of the company, and the board acting within its authority in permitting the signature later; that the failure o tfhe clerk to read the bid publicly did not matter, and that a substantial compliance with the formality of the law was all that was required; and that the company was the lowest bidder on bitulithic, though not the lowest bidder on any kind of material offered, and the board acted within its rights in selecting bitulithic as the paving material and letting the contract to the lowest bidder on that material.

MUNICIPAL AND TECHNICAL LITERATURE

An Acknowledgment—Municipal Reports—New Publications

Municipal Reports.

Report of the President of the Borough of Manhattan, New York City, for 1909. George McAneny, Pres.; Geo. W. Tillson, Chief Engineer of Highways.

The major part of the report is that of the department of highways. Much more work was done in 1909 than in 1908, the total of street paving and maintaining expenditure of $3,506,934 being nearly 3½ times as much in 1909 as in 1908. Most of the difference appears in the repaving, which was about 4 times as much in 1909 as in 1908, and in the new Riverside drive extension, on which $625,037 was expended. Notwithstanding all this work, the increase in mileage of improved streets, as shown in the 1909 report, was only 3.5 miles, and if one refers to the 1908 report, there was an actual decrease of 0.26 mile, there being a discrepancy in the two reports of 3.4 miles of macadam. The mileage of street pavements is now 258.80 of sheet asphalt, 47.82 of asphalt block, 87.62 of granite block, 10.73 of wood block, 29.53 of old stone block, 4.63 of macadam, a total of 439.13 miles. Contracts for 9.5 miles are not yet completed.

Granite block is the favorite where the traffic is heaviest. First avenue from 20th to 59th, formerly asphalt with an abandoned repair contract, was repaved with granite.

The widening of 5th avenue 15 feet with asphalt was made from 25th to 48th street. More than half the paving of the year was with sheet asphalt.

Asphalt block was used on grades and on petitions in the northern part of the island. About 80 per cent of the paving of the year was of asphalt, including sheet and block.

About two-thirds of a mile of wooden block paving was laid on petition. The only complaint about this pavement is its slipperiness, and its use on more than 2 per cent grades is therefore not recommended. The specifications for treating blocks were changed and the price was reduced, probably in consequence.

The average area of asphalt streets kept in repair during the year was 1,905,420 square yards.

The borough built 1.67 miles of sewer in 1909, increasing the mileage to 523.34. Of these sewers 248.8 miles were cleaned at a cost of $362.45 a mile.

An Acknowledgment.

One of the new magazines devoted to the improvement of cities from the standpoint of the citizen rather than of the official connected with the actual carrying out

of the work of physical improvement is *The American City*, which is edited by Arthur H. Grant, with a large advisory board. The numbers which have been received indicate a single-hearted devotion to the cause which should bring results. One of the recent articles was by Walter B. Snow, of Boston, and demonstrated the excessive cost of city work done by day labor in that city and the reasons therefor. This article was accompanied by some graphic illustrations which showed clearly to the eye the points made by the writer. Through the courtesy of Mr. Snow and *The American City* these illustrations were used in the March number of MUNICIPAL ENGINEERING with an article upon the same subject, but acknowledgment of our indebtedness was omitted inadvertently and is now made with great pleasure.

New Publications.

Accounting Every Business Man Should Know. By Elisha Ely Garrison. Cloth, 188 pp. $1.20 net, postage 12 cents. Doubleday, Page & Co., New York.

The author states that his purpose in this book is "to explain away the obscurity which frequently hides the real values and purposes of accounting." Briefly, he "explains the principles of business operation and finance," and as "simply," perhaps, as is possible with a subject so complex. For one who has the genius for accounting, though not expert in its details, he perhaps "clears away all obstacles," but to the ordinary mind he simply admits a light which shows the importance of the subject and the necessity of a broad view, as well as of expert attention to details.

If the book has faults they are in that it attempts too general a statement and presents the difficulties too often in advance of the place for their solution, so that a single reading is likely to leave an impression of confusion. The cross-references are so explicit, however, that a second reading, making the applications of the subsequent solutions to the difficulties as they appear, should bring order out of the mass of partly related ideas derived from the first reading.

The first chapters give a brief survey of the probable development of the processes of bookkeeping, giving an account of the origin and foundation ideas of accounts, the transition to modern methods, and the theory and practice of the ledger. After some discussion of the characteristics of accounts, the author takes up the separation of accounts into classes to be taken care of by various methods in cash books, records and ledgers of various designs, such as inventory, expense and revenue ledgers, department costs, etc. In more detail he discusses the fundamental principles of cost accounting, the devising of systems to suit the demands of the particular business, the governing ledger, the statement of the results of the operation of the business, the relation of the manager to the accounting system and the knowledge which the directors should have of it, and how they should obtain it.

One who fully understands all the statements and allusions in the book has already become an expert accountant, at least in theory, and the author is evidently doubtful of producing this effect upon all his readers, for he frequently emphasizes the necessity of procuring the assistance of expert acountants to prepare and install systems of accounting, to audit books, to interpret statements, balance sheets, etc. The book is worth the no small trouble of reading it with reasonably complete understanding if the reader gains a knowledge of the possibilities of pit falls in statements and balance sheets and some idea of how and where to look for them.

Concrete Inspection. A manual of information and instructions for inspectors of concrete work with standard and typical specifications. By Charles S. Hill, C. E. Cloth, 179 small pages, $1 net. The Myron C. Clark Publishing Company, Chicago, and New York.

Mr. Hill is a compiler of books who exercises judgment, and within the rather restricted limits he has set himself he has made a good collection of information, instructions and standards for inspectors of concrete.

The book begins with a chapter on the duties of the inspector in receiving concrete materials, cement, sand, aggregates and water and the methods of determining quickly their conformity with the specifications. The second chapter is on proportioning and mixing and gives the inspector many practical hints and instructions, one of the most important of which is to report perculiarities to his chief and find out what is required of him. Form work, lumber, workmanship and removal; reinforcement and methods of placing; the placing of concrete; joining of old and new work, and procedure in water and in freezing weather; details of methods of sidewalk construction; molding and driving concrete piles, each has a brief but comprehensive chapter.

Standard specifications are given as follows:

From the American Society for Testing Materials for cements.

From the American Railway Engineering and Maintenance of Way Association for Portland cement concrete and reinforced concrete.

From the building ordinance of St. Louis, Mo., for concrete building.

From the National Association of Cement Users the proposed standard building regulations for the use of reinforced concrete; for sidewalks; for hollow building blocks.

From the Concrete Steel Engineering Co., for material and workmanship for arch bridge construction.

ORGANIZATIONS AND INDIVIDUALS

Technical Meetings—Technical Schools—Personal Notes

Technical Meetings.

The annual convention of the Illinois Mayors' Association will be held at Cairo, Ill., May 18 and 19. The program includes the following papers: "Finances and Accounting of Cities," Hon. Edmund J. James, president University of Illinois; "Public Service Corporations and Their Control," Mayor N. T. Rawleigh, of Freeport; "Enforcement of Ordinances," E. S. McDonald, ex-mayor of Decatur; "Public Health and Sanitation," Dr. W. A. Evans, health commissioner of Chicago; "The Construction, Repair and Maintenance of Pavements," Clark G. Anderson, city engineer of Moline, Ill.; "Duties of Public Officials," Mayor Silas Cook, East St. Louis, Ill.

The next convention of the Indiana Municipal League will be held in Richmond, Ind., June 21, 22 and 23.

The annual convention of the Southwestern Electrical and Gas Association will be held at Beaumont, Texas, May 12, 13 and 14.

The annual meeting of the Appalachian Engineering Association will be held at Winston-Salem, N. C., May 6 and 7. Henry M. Payne, secretary, Morgantown, W. Va.

The semi-annual meeting of the Ohio Society of Mechanical, Electrical and Steam Engineers will be held at Cincinnati, Ohio, May 19 and 20. F. E. Sanborn, secretary, Ohio State University, Columbus.

At the meeting of the Municipal Engineers of New York city, April 27, Wm. G. Ford read a paper on "The Development of Jamaica Bay Into a Harbor for New York City." The society hopes to have a hundred responses so that it can make an inspection trip to the General Electric works at Schenectady, the Albany filtration plant, and the large lift lock at Cohoes.

The annual meeting of the National Electric Light Association will be held at St. Louis, Mo., May 23, 24, 25, 26, 27 and 28. T. C. Martin, secretary, 29 West Thirty-ninth street, New York City.

The spring meeting of the American Society of Mechanical Engineers will be held at Atlantic City, N. J., May 31, June 1, 2 and 3. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

The annual convention of the Engineers' Society of Pennsylvania will be held at Harrisburg, Pa., June 1, 2 and 3. E. R. Dasher, secretary, Gilbert Building, Harrisburg, Pa.

At a meeting of the Canadian Society of Civil Engineers in Montreal, April 7, a paper by H. S. Hancock, Jr., on "The Fort William Water Supply," was read by R. S. Lea.

A committee made up of representatives appointed by twelve different engineering societies has recommended the construction of a building for the scientific and engineering societies of Boston, similar to the Engineering Societies' building in New York City. Letters are being circulated to ascertain the membership possibilities for the new club. The societies represented on the committee are as follows:

Boston Society of Civil Engineers, American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Architects (Boston chapter), National Electric Light Association (New England section), New England Association of Gas Engineers, Illuminating Engineering Society (New England section), New England Street Ry. Club, New England Water Works Association, American Chemical Society (Northeastern section), Society of Chemical Industry, Telephone Society of New England.

The annual convention of the American Society of Civil Engineers will be held in Chicago, Ill., June 21, 22, 23 and 24. Chas. W. Hunt, 220 W. Fifty-seventh street, New York City.

The annual convention of the Society for the Promotion of Engineering Education will be held at Madison, Wis., June 23, 24 and 25. Henry H. Norris, secretary, Cornell University, Ithaca, N. Y.

The annual convention of the American Institute of Electrical Engineers will be held at Jefferson, N. H., June 27, 28, 29 and 30. R. W. Pope, secretary, 33 West Thirty-ninth street, New York City.

The annual meeting of the American Society for Testing Materials will be held at Atlantic City, N. J., June 28, 29, 30, July 1 and 2. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Pa.

The New England Water Works Association held a special meeting in Hartford, Conn., April 13. President King announced that the date of the annual convention, which is to be held in Rochester, N. Y., has been changed from September 14-16 to September 21, 22 and 23. The

cleaning of water mains, secondary water supplies, and forestry were the subjects discussed.

The annual convention of the American Water Works Association is in session as this number of MUNICIPAL ENGINEERING goes through the press. Report of the proceedings will appear in the June number.

The second national conference on city planning and the problems of congestion will be held in Rochester, N. Y., May 2, 3 and 4.

Technical Schools.

The April number of the Clarkson Bulletin gives the description of courses of study, equipment, facilities, etc., of the usual school catalog for the School of Technology at Potsdam, N. Y.

The forest products laboratory at the University of Wisconsin, Madison, Wis., will be opened formally on June 4. The university furnishes building, light, heat and power and the United States forest service the equipment, apparatus and 35 or 40 men to carry on the work. A number of vacancies in wood preservation, testing and chemical engineering work will be filed in May and June.

Union College, Schenectady, N. Y., opened its new general engineering building April 28.

"Unit Coal and the Composition of Coal Ash," by S. W. Parr and W. F. Wheeler, is issued by the Illinois University Engineering Experiment Station as Bulletin No. 37. This is a report of a series of experiments on coal, together with a tabulation of calculated values for unit coal for Illinois, Ohio, and other coal regions of the United States. The results show great constancy in the value of unit coal for any given mine or region, nothwithstanding the fact that the value of the natural coal as mined may vary between wide limits.

"The Weathering of Coal,' by S. W. Parr and W. F. Wheeler, is issued by the Engineering Experiment Station of the University of Illinois as Bulletin No. 38. This bulletin embodies the results of weathering tests conducted on car-load lots of coal for a period of one year, in the course of which coal from various mines was exposed in covered bins, open bins and under water. The results are presented in the form of charts which show graphically the losses in heating value resulting from each condition of exposure.

The tenth annual session of the Summer Schools for Engineers and Artisans, under direction of the College of Engineering of the University of Wisconsin, opens June 27th, continuing for six weeks. Advanced courses are offered in Direct and Alternating Currents, Hydraulics, Machine Design, Descriptive Geometry, Applied Mechanics, Shopwork, Steam and Gas Engineering and Surveying. Elementary courses for artisans, and those not having preparation for the advanced work, are offered in Applied Electricity, Engines and Boilers, Fuels and Lubricants, Mechanical Drawing, Machine Design, Materials of Construction, Shopwork and Surveying. The teaching staff is taken from the regular instructional force, and all laboratory equipment of the engineering college is available for students. For bulletin or further information address F. E. Turneaure, Dean, College of Engineering, Madison, Wis.

Personal Notes.

J. W. Mellor has been elected mayor at Sedalia, Mo.

J. P. Leggett has been elected mayor at Carthage, Mo.

J. B. Bullard has been elected mayor at Topeka, Kans.

Emil Seidel has been elected mayor at Milwaukee, Wis.

Robert E. Lee has been elected mayor at Springfield, Mo.

Hon. William Gilbert has been re-elected mayor at Laurel, Md.

W. U. V. Spencer has been elected mayor, at Webb City, Mo.

Samuel A. Carlson has been re-elected mayor at Jamestown, N. Y.

Morgan R. Butler has been elected city engineer, at Waukesha, Wis.

John W. Budd has been reappointed city engineer at Des Moines, Iowa.

Charles J. Baumgartner has been elected city engineer at Dubuque, Iowa.

Hon. Alvah P. Clayton has been re-elected mayor of St. Joseph, Mo.

Otto Matthews has been elected mayor and Zarna Patton councilman at Macon, Mo.

Ferdinand V. Wolfe, former mayor of Dover, N. J., died suddenly in that city, April 22.

William McGuilsery and William O. Kunkle have been elected aldermen at Carthage, Mo.

Dr. Tenney has been elected mayor, P. A. Turton clerk, and G. Ryffet treasurer at Alma, Mich.

Darius A. Brown has been elected mayor of Kansas City, Mo., succeeding Hon. Alfred F. Evans.

Thomas Fitzpatrick, J. O. Strubingle, and W. R. Wilson have been elected aldermen at Barry, Ill.

Edward L. Smith has been elected mayor at Hartford, Conn., succeeding Hon. Edward W. Hooker.

R. A. Hatfield, Miles Harrison, Gilbert Keith and M. F. Buckley have been elected councilmen at Trenton, Mo.

Theodore A. Leisen has been re-elected chief engineer and superintendent of water works, at Louisville, Ky.

John S. Filmley, Perry Hassiman, John Swadon and W. E. Kneeland have been elected aldermen at Griggsville, Ill.

Captain John E. Whittlesey, former mayor of Houston, Texas, died at his home in Washington, Conn., recently, aged 79 years.

E. F. Stebbins has been elected mayor and B. F. Harris, D. M. Ward, L. J. Karfenberger, and W. C. Brown aldermen at Lebanon, Mo.

William J. Welch, formerly water commissioner at Boston, Mass., has been reappointed to that position, succeeding William E. Hannan.

Louis W. Anderson, who recently resigned as city engineer of Grand Rapids, Mich., has formed a partnership with Charles J. Carpenter, under the firm name

of Carpenter & Anderson, and will conduct a general engineering and construction business.

A. A. Faucett has been elected mayor at Tacoma, Wash., and will be the first to serve under the commission form of government in that city.

E. W. Brown has been elected mayor, F. H. Farwell, B. G. Brown and Joe Weaver, aldermen, and K. A. Mitchell, secretary, at Orange, Tex.

Merritt H. Smith, M. Am. Soc. C. E., has been appointed deputy engineer of the board of water supply, New York City, to succeed Charles L. Harrison, resigned.

J. S. Worley, Kansas City, Mo., has been appointed a member of the commission to appraise the water powers of Michigan not already taken over by private corporations and individuals.

E. F. Ayers, of Beaumont, Tex., has been appointed state highway engineer for Oklahoma. A roads laboratory will be established at the Oklahoma Agricultural and Mechanical College, Stillwater.

T. H. Brannon, formerly assistant engineer, department public service, Columbus, Ohio, has been promoted to be engineer in charge of streets in that city, and will be succeeded by R. C. Chaney.

Mr. C. S. Davidson, a specialist in hydraulic and concrete work, has become associated with Mr. E. C. Crum, civil engineer and constructor, Frederick, Md. They will continue to do all classes of municipal and railway engineering and constructing, under the firm name of Crum & Davidson, at the present offices of Mr. Crum.

J. H. Titus has been appointed city engineer, to succeed J. H. Matthews, resigned, at Arkansas City, Kans. Mr. Titus has been consulting engineer on sewers and pavements for the city for the last six months.

Benjamin K. Hough has been appointed Boston sales manager for the Wisconsin Engine Company, of Corliss, Wis. He will have offices in the Oliver building, Boston, and will represent the company in the New England states.

Andrew W. Woodman and Albert B. Moore, of Chicago, have formed a partnership for the practice of civil, mechanical and electrical engineering, under the firm name of Woodman & Moore, with offices at 184 La Salle street.

H. J. Arrive has resigned as superintendent of water works at Houston, Tex., and will establish an office for general consultation and water works construction work. John B. Williams has been appointed to succeed Mr. Arrive.

John B. Gordon, Assoc. M. Am. Soc. C. E., has been appointed assistant engineer of the department of sewers at Washington, D. C., to succeed T. C. H. Baily, M. Am. Soc. C. E., who has been appointed enegineer in charge of street extensions.

MACHINERY AND TRADE

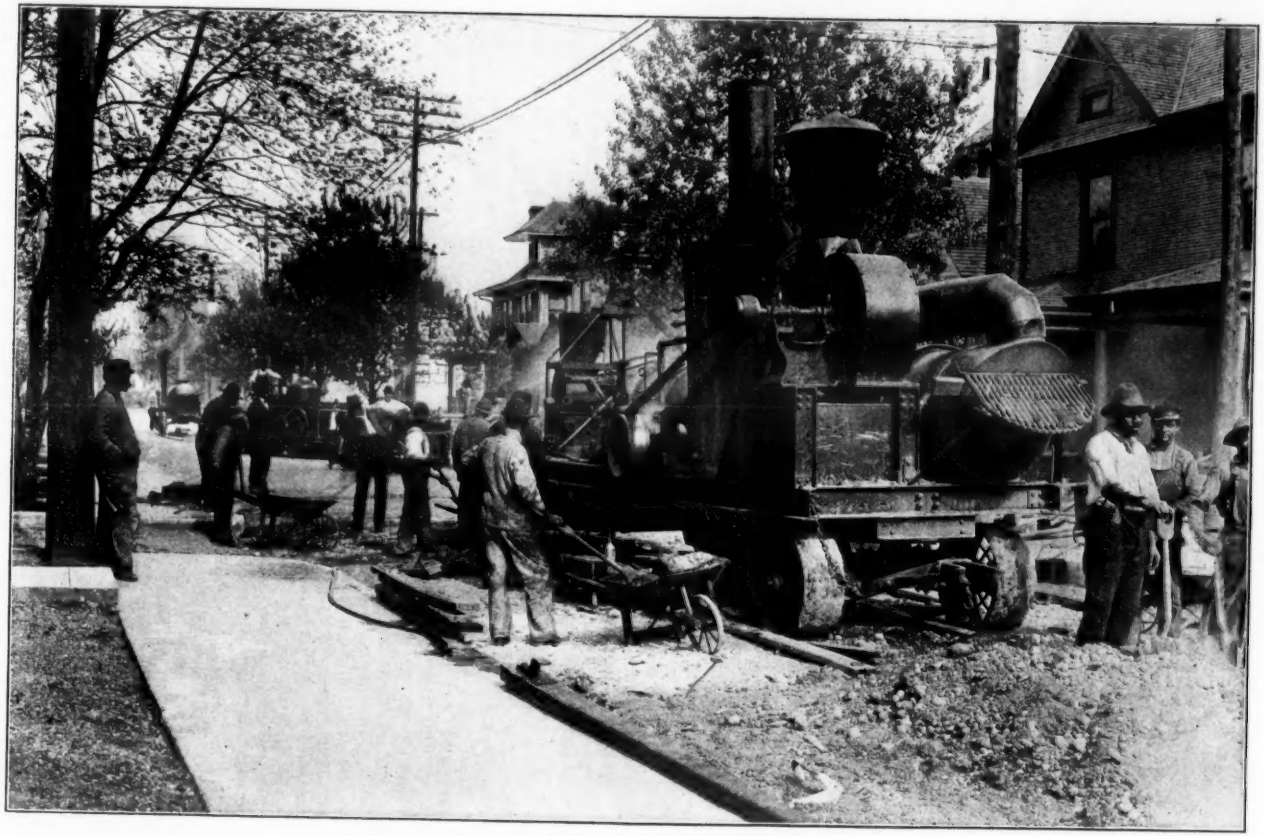
Bitu-Mass for Roadways.

Perhaps the most interesting of the processes for producing a good pavement for roads and lightly traveled streets at a low price is Bitu-Mass, on which has been spent two or three years of time and effort in developing the material, the process and the machinery for making the pavement. It is too long a story to tell at once, but some of the basic principles can be stated, to be followed by details of history and results.

The theory upon which the process has been developed is that heating the materials found in the roadway oxidizes organic matter and drives it off making the material equal to clean sand or broken stone. Muck or very fine loam could hardly be treated satisfactorily, but the material usually found on roadways in active use comes through the heating process in good condition for use in the new road surface. The specifications provide for the addition of gravel or broken stone and sand in case the old road surface is short of such materials.

The heated aggregate is mixed with heated bitumen, laid on the roadway and thoroughly compacted, producing a durable, smooth but not slippery, noiseless and dustless pavement.

The machine which produces this result is an important adjunct of the process. It is shown at work in the accompanying photograph. Projecting from the end of the machine is seen the chute leading materials to the rotary dryer. The end of the chute is covered by a screen which rejects everything more than one inch in diameter. The material from the old road surface, mixed with gravel or sand if necessary, is shoveled upon the screen and the material finer than one inch passes into the machine. No further handling is required, all of the machine operations being automatic until the paving mixture is dropped into wheelbarrows to be dumped in place on the subgrade and rolled into a finished wearing surface. The furnace for heating the material is located on the farther end of the machine, and all of the hot air and products of combustion are drawn through the dryer by the blower shown in the picture on the rear end of the machine, and the dust is collected in the Cyclone dust collector,



BITU-MASS ROAD MAKING MACHINE IN OPERATION.

also seen in the photograph, so that the machine is not a nuisance on the street. The dried and heated material discharges into a hopper at the farther end of the dryer and is carried by an automatic conveyor to a duplicate measuring box so that one side can fill while the other side is emptying. Near this box is another duplicate measuring device for the bitumen which flows from the heating kettle into one side or the other. The measuring boxes for dry material and hot bitumen discharge together automatically into a mixer of the usual design, and when the mixture is made thoroughly it is dumped into wheelbarrows.

The machine is self-propelling, is moved along as the pavement is laid, and this insures hot material in the roadway. It is 29 feet long, 10 feet in greatest width and in greatest height. The machinery is run by a 20 horsepower engine behind the vertical boiler seen in the photograph. The capacity of the outfit is 55 to 60 cubic yards in a 10-hour day.

The process of laying the pavement begins with the scarifying of the old surface, which is then removed to sufficient depth to give the desired finished surface when the pavement is completed, and deposited along the side of the roadway. An 8-ton roller is used for compacting the subgrade, and is later used after a 2½-ton roller in compacting the bituminous wearing surface. The material deposited along the road is then run through the heating and mixing machine, with such additional sand and gravel as may seem desirable, and, when deposited in place by the wheelbarrow, is rolled to a smooth, even surface in a compact layer by the rollers. For a country road the bituminous layer is ample if 4 inches thick. The thickest city street yet laid is 5 inches deep.

The company developing the pavement now has several streets of various ages and amounts of traffic, which demonstrate its excellent qualities and its adaptability to the various conditions of traffic. Some further description of these streets and of the adaptability of the construction to first-class country roads will be given later. Meantime the American Paving and Construction Co., Commercial Club building, Indianapolis, Ind., will supply any details desired regarding this very meritorious method of meeting the most pressing demand upon modern road constructors for a surface that will stand under automobile traffic and is reasonable in price.

The Stocker Washing Machine for Concrete Materials.

Many times materials for concrete, such as gravel, sand or crushed rock, are too dirty to pass specifications or to make good concrete and clean materials can be obtained only at great cost. In such cases an economical method of washing the materials is a great saver of cost and conserver of materials.

The Stocker Concrete Material Washer Company, of Highland, Ill., has patented a washer which will wash about 75 tons of material in ten hours, containing as much as 20 per cent. of clay, at an expenditure of 10 to 15 gallons of water a minute. It will remove all materials that will dissolve or float in water. When water is scarce it can be run from the machine to settling basins and used over again. It is operated by a 2-horsepower gasoline engine and a pump would be necessary if water of sufficient pressure is not available.

The drum of the washer is about 8 feet long and 30 inches in diameter and has a chain drive. The material is put in at one end, is stirred up by the revolution of the drum, which is fitted with riveted angle-irons on the inside and steel strips forming elevators which carry the material to the upper part of the drum, whence it drops into stationary steel chutes, which drop it back into the water to be taken up by the elevator and dropped into the next chute until it is finally discharged from the machine. The clean water enters at the discharge end of the drum and discharges at the other end.

Other sizes of the washer are also made and elevators for placing the washed material are also attached if desired.

Reports of the practical uses of the machine are very favorable, and it should in many cases save much in the cost of work where naturally clean materials are not readily available. The company will give full information about the machine on request.

Acme Corrugated Metal Culverts.

From an article on "Experience with Pipe Culverts of Corrugated Iron," describing this form of drainage conduits in detail, the following description of the Acme culvert is extracted. It shows the good points of this culvert and its durability. The new catalog will be sent on request.

The Acme corrugated metal culvert, made by the Canton Culvert Co., of Canton, Ohio, is so designed as to enable it to be shipped either set up complete, or in semi-circular sheets nested together and ready to be erected in the field. The sheets have interlocking flanged ends, which are bolted together, forming two longitudinal ribs. The culvert is so made that the flanges provide ample bearing surface, while the bolts prevent spreading at the joint. The circular seams are made by lapping the corrugations, the upper and lower sheets breaking joints. An advantage of this construction is that the sheets can be nested and packed in bundles for convenience of transportation. For special purposes, flat corrugated bottom plates may be used, making a culvert of semi-circular section.

Perforated corrugated plates are used in some cases for the upper half of drains or

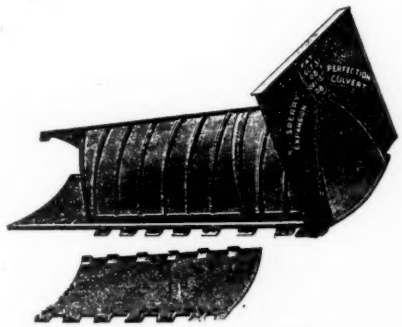
culvert of both circular and semi-circular section, the plates being made for diameters of 8 inches to 36 inches. These plates have ½-inch holes of 4 inches pitch (staggered) in the valleys of the corrugations. After being punched these plates are galvanized by the hand-dipped process so that there are no exposed edges.

The sheets are made of a special galvanized material, termed "No-Co-Ro" metal, and the company states that the manufacture (from the furnace to the finished product) is under its supervision and direct management in its local mill connections. Comparative tests with solutions of sulphuric acid are said to have showed a rust-resistance five times higher than that of charcoal iron and over sixteen times that of steel.

The "Acme" culverts have been used extensively in this country, and to some extent in other countries. They are made in diameters of 8 inches to 6 feet, with metal of Nos. 16, 15 and 14 U. S. gage for the smaller sizes, and Nos. 12 and 10 gage for the larger sizes. The sheets are in 26-inch lengths, with 2-inch laps, making a finished length of 24 inches. It is estimated that when properly laid a life of 20 to 25 years may be expected.

Sperry Expansion Culverts.

The Portsmouth Machine and Casting Co., Portsmouth, O., has placed on the market a patented cast iron culvert, which presents some new and interesting features in culvert construction. In its design the inventor has endeavored to secure a culvert which will not only fill all the requirements of a road culvert, but one which will reduce the cost of maintenance to a minimum. Being made of cast iron, it is practically impervious to the action of rust, which makes it much more durable than the average metallic culvert. It is made in short sections (the longest being three feet), which connect up together to make any desired length. This feature makes the culvert easy to ship, easy to handle and easy to place in position.



SPERRY ROAD CULVERT.

Expansion is provided for by the use of curved tongues on the side walls and slotted holes along the edges of the bottom by means of which the base and sides are locked together, yet leaving sufficient play to prevent breakage by the action of either frost or traffic. Nor is it possible for the culvert to settle out of line. In case of washouts or freshets, a Sperry culvert may be carried away, as any culvert might, but because of its sectional construction it may easily be reassembled and replaced. The capacity is said to be slightly more than that of a corresponding size of round pipe, owing to the greater pressure on the broad base. Its great strength is shown by the guarantee under which it is sold, to withstand the weight of a 20-ton road roller with a cover of six or more inches of good road bed, or the strains of heaviest railroad loadings with a cover of four feet or more. For ordinary interurban traction purposes two to three feet of cover is usually sufficient.

The culvert has been quite extensively used in the east for several years, and has been adopted by one of the leading railroads in New York state. For tramway and county road construction it has also become quite popular in certain districts. In appearance, the culvert is neat and ornamental when in place, the head walls allowing any desired dressing of banks or overfill.

The Portsmouth Machine and Casting Co., Portsmouth, O., has the exclusive manufacturing sales rights in several states.

The Story of Market Street, Philadelphia.

Probably never in the history of American cities has a matter of street pavement loomed so large in the public imagination, or become so widespread a subject for intense partisanship, as the case of Market street in Philadelphia, during the past season. For a year or more Market street was in chaos on account of the building of the subway. Traffic had been greatly reduced on account of the rough going, and pedestrians were avoiding the thoroughfare on account of the dirt and confusion. Market street is the center of the retail shopping district of Philadelphia, and its merchants suffered enormous losses through the diversion of traffic to other streets, as well as in the difficulties and delays in shipping and receiving goods.

When the subway at last was covered in and the question of pavement came up, the Market street merchants got together and formed an association, including practically all the retailers on the street, for the purpose of protecting their interests and seeing to it that Market street was paved with a pavement that would attract traffic and accord with the comfort and convenience of pedestrians. The old Market street pavement had been granite blocks, and the merchants wanted no more of it. Granite block pavement was rough, frightfully noisy, and not easy to clean. Sentiment among the merchants at first was for asphalt or brick, as these were the only smooth pavements with which they were then familiar. Then came the suggestion of wood block pavements, and

a committee was sent to other cities, especially New York, to get pointers on the subject. It returned enthusiastic for wood block pavement, on the ground that it was quieter than brick or asphalt, much more durable, and very clean.

The next step of the merchants was to employ a firm of pavement testing experts to prepare a special report and to recommend the pavement that would best suit Market street conditions. The experts submitted an elaborate and complete report, covering the paving field with great care from the standpoints of durability and other desirable qualities. The report was entirely unbiased. The facts reported were highly favorable to the wood block proposition.

By this time the merchants were unanimous, and they began making vigorous representations to the city council and the mayor, and forced the city authorities to investigate the subject themselves. At the same time they stimulated newspaper discussion, and before long the entire town was talking about pavement stresses, pavement guarantees, etc., and the wise citizens were explaining to the rest how a wooden street could be made that would last longer than stone. Public sentiment soon came to favor the wood block pavement as strongly as the merchants did, and the largest wood block pavement contract that has yet been let in this country was finally signed by the mayor.

While the pavement was being put down the work was regarded as one of the sights of the town. Thousands of citizens who had fought for the pavement came to witness the laying of the first block with appropriate ceremony. So watchful were the people that the discovery of an occasional imperfect block in the piles on the sidewalk caused a "tempest in a teapot" for a day, until the matter could be satisfactorily explained in the newspapers.

After the pavement was completed and the barriers removed, traffic flooded into Market street as never before. Philadelphians found that it made pleasanter pavement to ride over; pleasure vehicles began to use the street in great numbers; and for pedestrians it immediately became the favorite street in the city. The remarkable reduction in noise made it a pleasanter place to walk; one turned into the street with a feeling of relief after the uproar of neighboring stone pavements.

The Christmas shopping season brought to the Market street merchants a record business, and they openly and repeatedly testified in the newspapers and elsewhere that the new pavement had been responsible for it, and had made Market street the favorite haunt of the shopping public.

Their satisfaction was shown again in February when the city was visited by a committee of Chicago officials, who were making a tour of the large cities to investigate and inspect various kinds of street pavements. The Market street merchants took the trouble to entertain them and appeared before them with enthusiastic indorsement for wood block pavement. Mr. Ellis A. Grindell, one of the big merchants, said that from the beginning he felt confident that it was the ideal pavement for business streets, and that the campaign entered into by the merchants had been fully justified by results. Mr. Ralph Blum declared that the claims of the merchants that wood paving was sanitary, clean and noiseless and in every way adapted to the needs of business houses, have been already demonstrated Mr. J. R. C. McAllister, chairman of the Finance Committee of the Council, told of a popular measure he had introduced in councils providing for wood paving on all the central streets of the city. He said, "I can safely predict that in less than ten years the entire business district of this city will be paved with creosoted wood blocks." This measure was backed up by the merchants in an elaborate resolution in which they said: "As a means of attracting the shopping public, enhancing property values, facilitating transaction of business, the installation of the silent and sanitary wood paving such as we have on Market street has already demonstrated its efficiency to the thorough satisfaction of practically every business merchant."

At the present time petitions are before the authorities for other downtown retail streets, especially Walnut and Chestnut streets, urging an extension of wood block pavement. It seems likely that with this powerful public sentiment in favor of wood, the aspect of Philadelphia will be radically altered within the next few years.

Where Trench Braces Are Necessary.

BY C. P. BLACKISTON.

Trench braces were brought into novel and effective use in Youngstown, Ohio, recently when that city was visited by a severe cyclone and cloudburst, one to be long remembered.

Along one of the principal thoroughfares of the Buckeye city a large watermain was being placed, the excavating having just been completed at heavy expense. When the cloudburst happened along, the engineer in charge, perceiving the danger to his trench, ordered a dam of planking built along the upper side, braced by Bunn pipe-expansion trench braces, which were being used.

Before the heavy downpour was long in progress, the wisdom of the engineer was seen. From the steeply graded cross-streets came a raging torrent, carrying with it all manner of debris from above. The improvised dam formed an immovable barrier. The braces would not give an inch, so the rush of water was checked, the trench was unharmed, and incalculable damage to property on the lower side of the street was averted.

A case quite similar to that above happened the other day in Pittsburgh, when a large water-main burst in Highland Park. The water, given its freedom, rushed down over the terraces and over the right of way of the Allegheny Valley Railroad, blocking all traffic for several hours.

Workmen finally succeeded in building a temporary dam in front of the break, closing the gap by means of Dunn trench braces.

For such emergencies as these the Dunn braces are advantageous beyond the ordinary uses and strains placed upon a trench brace owing to its pipe extension features and machined threads, insuring easy operation. The ball and socket bases of these braces makes it possible to operate them in any position.

Methods of Testing Creosote Oils.

The Bulletin No. 65 of the American Railway Engineering and Maintenance of Way Association, giving the methods of testing creosote oils prescribed in the standard specifications for wooden block pavements adopted by the Organization for Standardizing Paving Specifications, can be obtained for 50 cents of the secretary of the association, E. H. Fritch, 962 Monadnock block, Chicago, Ill.

Imperial Waterproofing.

A. F. George Company, of Los Angeles, Cal., has perfected a waterproofing preparation for concrete which has successfully stood some severe practical tests. A letter recently written to the manufacturing company by the Board of Supervisors of Los Angeles county shows the results of one of these tests.

Los Angeles, March 21, 1910.

It gives us pleasure to make a statement concerning the efficiency of Imperial Waterproofing.

When you offered to stop the flow of water coming into the court house elevator tunnel, running from New High street to the court house elevator, we looked upon your proposition as a huge joke, as the water was flowing like springs in a great many places all over the roof of the tunnel, but today there is not a particle of water flowing into the tunnel, or any indications of water whatever; besides, you have improved the appearance of our tunnel one hundred per cent., and the small amount of expenditure we have made in applying the waterproofing is very much appreciated by the public.

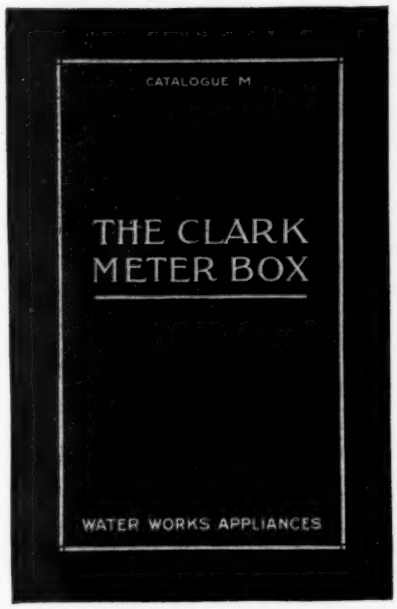
Imperial Waterproofing is certainly a wonder, and if it is permanent as you claim, it is certainly one of the most valuable commodities on the market.

Signed by C. D. Manning, H. D. McCabe, S. T. Eldridge, C. J. Nellis, R. W. Pridham, Board of Supervisors, Los Angeles County, California.

Imperial waterproofing can be applied on the surfaces with a brush or mixed in with the concrete. It will not discolor the materials on which it is used, but can be colored, if desired, by the use of indelible dyes. It is very penetrative and combines with the material, so that it will not crack or peel.

The Clark Meter Box.

The accompanying cut shows the cover of the new catalog of H. W. Clark Company, Mattoon, Ill. It gives a history of the development of the box, a full description of the present forms and the methods by which it is adapted to all conditions—frost of the north and warm weather of the south. Many styles of covers and lids are shown, meeting all requirements;



also collapsible forms for making the box bodies, meter couplings, service box keys, inspectors' and special gauges.

Mr. Clark is a water works superintendent with many years of experience, and his inventions are the outgrowth of the conditions he has met, and they are therefore eminently practical.

One of the interesting things in the catalog is the description of Mr. Clark's method of operating deep wells, and the apparatus which he has developed to increase the economy and certainty of the service.

He will send copies of the catalog on request, including the price list and telegraphic codes.

How Portland Cement Is Made.

The writer has been reading with great interest the description of the method of making Portland cement, which appears in a booklet describing "A Little Journey

to Our Mills at Superior, Lawrence Co., Ohio," which is issued by the Superior Portland Cement Co., Union Trust building, Cincinnati, O., and wants to recommeend it as both interesting and valuable to any one who uses Portland cement, no matter whether he is interested in the particular kind of cement or not. But one who reads the booklet can scarcely fail to become interested in the product of so excellent a plant, using such excellent materials. Send for the booklet in any event. It is worth the trouble and the stamp many times over.

Nordell Sewer Slide Rule.

The Nordell sewer slide rule has been designed to overcome the difficulty and avoid the usual labor incident to finding the time of running in sewers. It is so arranged that if the length, drop and size of a sewer are known, one setting will give the time required to flow the given length. By its construction the necessity of reducing to a rate per cent in order to find the capacity of a sewer is also avoided.

The rule is based upon the Chezy formula, Kutter's formula being used to determine the value of *c*, and it applies to circular sewers only. Correct positions on the scale are worked out for the coefficient of friction N equals .013 and .015 for brick or concrete sewers, and N equals .013 and .011 for pipe sewers. Different coefficients may be proportionately interpolated if desired.

The determination of run-off in sewers has been, from the beginning of storm-water sewer design, based very largely on empirical formulas, which give correct results only for areas identical with those from which they were derived, because some very important factors in determining the run-off, such as the shape of the area drained, the manner of collection and the time of concentration are left out of consideration entirely.

The main advantage of the Nordell sewer slide rule lies in the fact that it simplifies the application of the more correct methods of storm-water run-off determination involving the time of concentration in sewers. Heretofore the labor of finding this factor has been such that engineers would turn to empirical formulas giving doubtful results, rather than to a method involving the time of concentration, as without the use of this slide rule the velocity must be obtained from tables which involve a product of several factors, and the time in minutes then found by dividing the length of a sewer by the velocity in feet per second and reducing to minutes.

To further increase the value of the rule, it has been made in the duplex type. All graduations which are intended to be used purely for sewer calculations are upon one face of the rule, while the reverse face has the regular 20-inch A, B, C and D scales for computations of a more general character.

The use of the rule is as follows: Suppose at a certain point a quantity of 100 cubic feet per second is to be discharged through a sewer 700 feet long, whose coefficient of friction is .015. If 700 on the left-hand L scale is set under the required quantity, 100, on the cubic feet per second scale, the different drops required by various sizes of sewers may be read off on the left-hand H scale over the divisions corresponding to the sizes on the line N equals .015. If the coefficient of friction were assumed as N equals .013, the rule would be set as before, but the required drop would be read on the left-hand H scale over the division on the line N equals .013. It will be seen by the form of the rule that any coefficient may be interpolated by drawing lines connecting the corresponding divisions on N equals .013 and N equals .015 and also a horizontal line at a proportional distance between the other coefficient lines. By using the runner to project the intersections to the H scale the rule is read as before.

Suppose the sewer to be established and the time of running wanted. The method of procedure is as follows: Find the drop of the sewer on the right-hand H scale and set it over the division corresponding to the size on the line representing the assumed coefficient of friction. The time in minutes may then by read off on the T scale over the division corresponding to the length on the right-hand L scale. With the same setting the velocity in feet per second may be read off by looking over the length on the left-hand L scale and dividing the reading by 10, as indicated by the supplementary red figures.

The scales are adjusted for the sewer running 0.8 full, a point where the velocity is practically the greatest and the discharge 98 per cent of the discharge running full, thus providing for a maximum rapidity of collection with a margin of carrying capacity. A "Parts Full" scale is provided for converting the discharge for other depths of flow on the left-hand side and a similar scale for converting the time and velocity on the right-hand side of the rule.

The rule is made by Keuffel & Esser Co., 127 Fulton street, New York.

Trade Publications.

Berkshire pamphlet No. 1, by Albert Moyer, gives specifications for using White Portland cement mortar.

The H. Mueller Mfg. Co., Decatur, Ill., announce that "Summer's Comin'," in a new catalog showing their water main tapping machines, cocks and connections, flange work, meter testers, strainers, regulators, tools, etc. It is a condensation of the Mueller catalog showing the lines of goods most in demand at this season. It will be sent on request.

The Stone & Webster Engineering Cor-

poration has printed an elaborately illustrated account of their enargement of three power stations for the Boston Elevated Railway Company, under the title "Came the Power with the Need."

The ten business commandments and an added eleventh as the Lehigh Portland Cement Company would have it, are the latest from the Indianapolis office of the company. The concrete dry dock of the Toledo Ship Building Company is the subject of another pamphlet.

Bulletin 71 of the Universal Portland Cement Company is largely devoted to reinforced concrete buildings. Another bulletin gives the results of an investigation of cement drain tile with full evidence of their lasting qualities. Reproductions of the Universal advertisements in the Chicago papers during the cement show are also distributed.

Standard road oil is fully described in a handsomely illustrated pamphlet issued by the road department of the Standard Oil Company of New York, 26 Broadway. Asphalt road oils, emulsifying road oil, macadam asphalt binder, oilers, distributers, topping oilers, pipe sprinklers, the Saybolt road oil distributer, hand sprinklers, heaters, tank cars and wagons are all shown. Specifications in detail for oiling roads, for asphalt and bituminous macadams are given in full. Copies of the booklet will be sent on application to interested persons.

Circular No. 13 of the Ashland Steel Range and Manufacturing Company, Ashland, Ohio, shows briefly but clearly and completely the advantages of their U. S. standard concrete block machines, the appearance of buildings made of them, the structure of the U. S. standard continuous concrete mixers and the make up of the various sizes and styles sold by the company. It will be sent on request.

Aquabar, "the absolute and reliable waterproofer," sold by the Girvan-Nachod Co., general sales agents, 1228 Locust street, Philadelphia, Pa., is well described in a circular and some attached letters from satisfied users.

Jeffrey roll crushers are shown in Bulletin No. 39 of the Jeffrey Mfg. Co., Columbus, Ohio.

Edison Aggregate for April is devoted to churches, schools and theaters.

Trade Notes.

ASPHALT.

Spokane, Wash.—The Inland Empire Hassam Paving Co. has been incorporated and will enter into the paving business here. The incorporators are Martin Woldson, Daniel G. Munro, Charles E. Swan, W. A. Lucy and George M. Ferris.

BRICK.

Steubenville, Ind.—The Steubenville Brick and Tile Co. has been incorporated to manufacture and sell clay brick and drain tile, by Chester C. Klink, Robt. Lacey, and Alvin Goodwin.

Mt. Clemens, Mich.—The Miller Vitrified Brick Co. has been incorporated and will erect a paving brick plant.

Oakland, Cal.—The Oakland Paving Brick Co. has been incorporated.

Albion, Ill.—The Albion Shale Brick Co. has been organized and will build a paving brick plant here.

Hudson, N. Y.—A company is being organized to erect a plant for the manufacture of shale paving brick.

El Reno, Okla.—The El Reno Vitrified Brick and Tile Co. has been incorporated by A. E. Lane, Harry Lane, A. C. Krepke and N. A. McLean.

Tulsa, Okla.—The Tulsa Paving and Building Brick Co. has been incorporated by Geo. W. Rose and others.

CEMENT.

Winnipeg, Man.—The Central Portland Cement Co., Ltd., has been incorporated by William Fox, Valdimar J. Melsted, of Minneapolis; Chas. Blake, Leonard Cashmore, and Henry F. Tench, of this city. The business offices are located here.

Erie, Kans.—Seth G. Wells, ex-state auditor and receiver of the Chanute Cement and Clay Product Co., announced that he would sell the entire plant at Chanute at public sale on April 15.

CONCRETE BLOCKS.

Findlay, O.—Tarbox & McCall have purchased machinery and will erect a building for the manufacture of cement and drainage tile.

Deer Lodge, Mont.—(Special). H. B. Grant, city enegineer, advises us that he is interested in designs of concrete buildings.

PURCHASE OF MACHINERY.

St. Paul, Minn.—Sealed bids are asked until 2 p. m., May 2, for furnished a road roller. Geo. T. Reddington, secretary, board park commissioners.

St. Louis, Mo.—(Special). W. C. Reed, 3800 Park boulevard, is in the market for a concrete mixer, brick hoist, wire rope, sheaves, etc.

Whitman, Mass.—(Special). A. P. Trufont is in the market for an attachment for a sprinkling cart to apply light oil or heaviest grade of tar.

Chicago, Ill.—(Special). Theodore Ohlborn, 932 Greenwood Terrace, is in the market for contractors' equipment; also cement, sand, stone, gravel, asphalt, tar and sewer pipe.

Wilmington, O.—(Special). L. L. Compton, P. O. building, desires to investigate cement tile machines, post and brick machines.

PURCHASE OF MATERIALS.

Creston, Ia.—(Special). Theodore S. DeLay, city engineer, desires the addresses of all producers in this country of tar cements suitable for the construction of bituminized macadam roadways.

LIGHT, HEAT AND POWER.

Buffalo, N. Y.—The Myers Gas Generator Co. has been incorporated to manufacture and deal in machinery operated by gas, etc., and manufacture and deal in all kinds of gas machinery and fixtures, by C. H. Myers, P. L. Marvin and J. H. Schumaker.

MISCELLANEOUS.

Chattanooga, Tenn.—The Municipal Engineering and Construction Co. has been incorporated by W. A. Sadd, Joe Brown, Frank Sperlock, A. D. Glover and Foster V. Brown.

Patents Concerning Sewers and Drains.

858,638. Tile Mold. John J. Swenson, Roswell, N. M.
873,634. Concrete Tile Mold. Wm. S. Thomas, Eaton, Colo.
887,225. Manufacture of Concrete and Like Pipes. Olof Kjellstroem, Stockholm, Sweden.
889,440. Reinforced Concrete Pipe. Chas. H. Cartlidge, LaGrange, Ill.
893,328. Centering for Concrete and Tile Construction. Wm. S. King, San Francisco, Cal.
893,695. Concrete or Cement Pipe. Edward H. Ames, Columbus, O.
894,517. Concrete Pipe. Coleman Meriwether, Montclair, N. J.
895,904. Tile Mold. Howard A. Smyth and Otto Perschbacher, Wichita, Kan.
896,835. Apparatus for Cleaning Sewers. John Kelly, Jamaica Plains, Mass.
898,205. Drainage System (from gutters). Karl Filskow, New York, N. Y.
898,498. Cement Pipe Making Machine. Herman Besser, Alpena, Mich.
903,022. Sewer Cleaning Apparatus. Wm. H. Stewart, Boston, Mass.
904,033. Concrete Mold. Wm. B. Weldon, Chicago, Ill.
904,900. Mold for Forming Concrete Drain Tile. Samuel L. Sheets, Paris, Ill.
905,646. Machine for Making Cement Drain Tiles. John Cardiff, Potomac, Ill.
906,034. Sewer Cleaning Apparatus. John Kelly, Jamaica Plains, Mass.
906,953. Metallic Culvert. John E. Sperry, Munnsville, N. Y.
907,159. Cap for Sewer and Other Pipes. Geo. O. Miller, North Tonawanda, N. Y.
909,027. Metal Drain Pipe. Joseph A. Sanders, Cayuga, Ind.
909,344. Sewer Pipe. Chas. M. Stratton, Toronto, O.
909,354. Sectional Conduit. Wm. G. Wight, Yale, Mich.
910,577, 910,578. Method and Apparatus for Molding and Laying Concrete Pipes. Ernest L. Ransome, New York, N. Y.
911,321. Sewage Ejector. Wm. McClintock, New York, N. Y.
911,368. Road Culvert. Louis Blakestad and Ole A. Anderson, Lyle, Minn.
912,318. Reinforced Concrete Pipe Structure. Harry R. McMahon, Cleveland, O.
912,428. Block for Sewer Construction. Chas. H. Slocomb, Hartford, Conn.
912,638. Culvert Pipe. Carl O. Wold, Minneapolis, Minn.
913,036. Sewer Pipe Coupling and Connection. Mads Nelson, Canton, O.
913,131. System for Ventilating and Purifying Sewers and the Like. Edward T. Head, Sudbury, Ont.
913,662. Composite Pipe. John T. Langford, Newton, Mass.
914,032. Expansible and Contractible Core for Making Cement Conductors (pipes). Mathias Engeln, McHenry, Ill.
914,066. Sewer Trap. Ben Oakes, Detroit, Mich.
914,110. Culvert. Henry A. Brownell, Flint, Mich.
915,086. Culvert Pipe. Sam T. Ferguson, Minneapolis, Minn.
915,266. Culvert. David C. Boyd, Galion, O.
915,640. Press for Making Sewer Pipe and the Like. Calvin W. Vaughn, Cuyahoga Falls, N. Y.
916,587. Reinforced Concrete Pipe Coupling. John M. Phelan, Jackson, Mich.
916,654. Sewer Pipe Cleaner. Scott E. Barwis, Altoona, Pa.
917,892. Sewer Cleaning Apparatus. Wm. A. Pierce, Boston, Mass.
918,030. Culvert Mold. Wm. C. Fife and Stanley R. Coleman, Carson City, Mich.
918,723. Culvert (metal). Chas. F. Alt, Warren, Pa.
919,997. Corrugated Metallic Culvert. John Zeich, St. Paul Park, Minn.
920,317. Mold for Making Cement Concrete Pipes.
921,497. Mold for Concrete Culverts. Thos. B. Abercrombie, Welden, Ia.
924,553. Mold (Cement Tile). Lorenzo D. Irish, Mason, Mich.
925,019. Culvert. Morden F. Parks and Oswald Parks, Cahac, Mich.
928,265. Culvert. Gilbert Mahoney and Frank A. Rounds, LeRoy, Minn.
928,606. Conduit (Road drain). Willard Houghton, Brinnon, Wash.
928,812. Machine for Making Concrete Tiling. Ransom Z. Snell, South Bend, Ind.
928,826. Underground Conduit (Concrete). Sylvester B. Way and Elisha C. Freeze, St. Louis, Mo.
928,938. Means of Cleaning Sewers. Frank A. Cerrute, New York, N. Y.
929,644. Concrete Manhole or Catch Basin. Parrott G. Harshbarger, Hyde Park, Mass.

Patents Concerning Sewage Disposal.

860,930. Apparatus for Separating and Purifying Sewage and the Like. Erich Mertens, Berlin, Germany.
875,984. Portable Apparatus for Liquefying and Purifying Sewage. Fredk. J. Commin, Exeter, Eng.
890,433. Sewage Disposal Apparatus. Wm. C. Matthias, Reading, Pa.
891,742. System of Sewage Disposal. Fred P. Smith, Kansas City, Kan.
895,229. Method of Treating Sewage. Cecil C. E. Beddon, Wallingford, Pa.
904,141. Apparatus for Discharging the Contents of Septic or Settling Tanks and the Like. Samuel F. Miller, Chicago, Ill.
904,324. Sewage Distributer. John W. Hartley, Stoke-upon-Trent, England.
909,340. Liquid Controller. Wm. S. Shields and Jas. W. Cox, Chicago, Ill.
917,663. Septic Tank. Henry C. Rogers, Estes Park, Colo.
919,200. Sectional Cesspool. Dennis J. Menton and Henry Welchmann, Richmond Hill, N. Y.
924,664. Sewage Treatment Apparatus. Karl Imhoff, Bredeney, Germany.

Patents Concerning Sidewalks, Curbs and Gutters.

856,409. Concrete Sidewalk. Donald G. MacDonald, Detroit, Mich.
856,702. Cencrete Gutter Machine. F. Howley, Pittsburg, Pa.
858,959. Guarder for Edges of Concrete Paving. Wm. Crenshaw, Atlanta, Ga.
861,655. Bracing for Sidewalks. Jacob Jacob, New York City.
861,686. Form for Making Concrete Curb or Gutters. Chas. E. Twitt, West Tampa, Fla.
864,069. Pavement Marker. Rudolph S. Blome and Wm. J. Sinek, Chicago, Ill.
864,276. Metal Nosing for Concrete Curb and Other Structures. Henry H. Wainwright, Philadelphia, Pa.
872,602. Form for Concrete Sidewalks. John R. and Adlow Zeiser, Berwick, Pa.
875,025. Curb Protector. Samuel Whinery, East Orange, N. J.
893,320. Edge Protector for Concrete. Eugene F. Glock, Detroit, Mich.
890,011. Reinforced Concrete (Sidewalk) Slab. Anton F. Anderson, Steger, Ill.
881,700. Reinforced Concrete Sidewalk. Francis J. Miller, Detroit, Mich.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Binghamton, N. Y.—Pavement repairs will begin in this city May 1.

Georgetown, Tex.—About four miles of cement sidewalks and street crossings have been constructed in this city during the last three months.

Bayonne, N. J.—A verdict for $237,832.08 was returned by a jury in the circuit court, April 11, in favor of William T. S. Crichfield and against this city, for money which Crichfield claimed was due him for repairing Broadway.

Salina, Kans.—Suit has been filed here April 2 by Haskins & Ramsey, a street paving company of Topeka, against the Kaw Valley Paving Company, of Topeka, and Mayor Charles B. Kirtland and the members of the city council of this city, asking for a restraining order to prevent the Kaw Valley Company and the city officials from proceeding with a paving contract made at the last meeting of the council. The plaintiff company asserts in its petition that its bid for the work was 20 cents a square yard less than the defendant company's bid. A temporary restraining order was granted and the case will be heard May 5.

CONTEMPLATED WORK.

Muncie, Ind.—Brick paving is contemplated for S. Council st.

Brazil, Ind.—Tarvia will be used on sundry streets this summer.

Hammond, Ind.—Plans have been prepared for paving an alley.

Winnetka, Ill.—Brick paving is contemplated for Railroad ave.

Knoxville, Ia.—Paving is contemplated for a number of streets.

Matthews, Ind.—Brick paving is contemplated at a cost of $17,328.

Gilman, Ill.—Plans are being prepared for 2,400 ft. of brick paving.

Bemidji, Minn.—Council contemplates paving the business district.

Ledyard, Ia.—The village council has condemned several sidewalks.

Reading, Pa.—Paving and repairing is contemplated for several streets.

Dunkirk, N. Y.—Council has voted to pave Swan st. from 3d to 7th sts.

Wadesboro, N. C.—This city voted to issue bonds for street improvements.

Davenport, Ia.—Plans have been prepared for paving an alley with brick.

Schenectady, N. Y.—Asphalt paving is contemplated for River road and Avenue A.

Olean, N. Y.—Brick paving is contemplated for three streets. Geo. J. Ball, cy. Engr.

Sedgwick, Kans.—Petitions have been filed for constructing 9 mis. of sand clay road.

Waterloo, Ia.—The city council has decided to grade, curb, gutter and pave W. 3d st.

Northfield, Minn.—The paving of W. 3d st. at a cost of $10,000 is contemplated.

Chariton, Ia.—Vitrified brick paving is contemplated for Grand st. and Auburn ave.

Marshalltown, Ia.—Objections will be heard May 20 (postponement of date), on the resolution to pave certain streets.

Pueblo, Colo.—The property owners have petitioned for about 40 blocks of streets in the central part of the city.

Pekin, Ill.—Cy. Engr. Van Deusin estimates the cost of paving 15,905 sq. yds. of S. 4th st. with brick at $27,162.93.

Glencoe, Ill.—Plans are being prepared for street improvements to include cement sidewalks, sewers, and water mains.

Hernando, Miss.—This city will issue $10,000 bonds for constructing cement sidewalks, the contracts to be let soon.

Selma, Ala.—This county will vote May 16 on the issue of bonds for constructing good roads in all sections of the county.

Williamson, W. Va.—(Special). Claude L. Gaujot, C. E., advices us that this city contemplates considerable street paving.

Des Moines, Ia.—Plans are being prepared by J. W. Budd, cy. engr., for paving 19th st. with concrete, and 26th st. with asphalt.

Moulton, Tex.—The property owners in Live Oak, the principal business street, are taking action toward paving that street.

Paxton, Ill.—Bids will be received on materials, about May 15, for about 1 mi. of tarvia macadam paving. C. F. Holman, cy. engr.

Paris, Ky.—Bourbon county contemplates expending an appropriation of $42,000 on the turnpikes this year, in building and repairing road beds, and constructing new bridges and repairing old ones.

East Orange, N. J.—Asphalt block has been recommended as the material for repaving Main st. Joseph Lee, chm. road com. cy. coun.

Antigo, Wis.—B. W. Rynders, mayor, recommends resurfacing the present macadamized streets, macadamizing other streets, etc.

Houston, Tex.—Plans are being prepared for converting Buffalo bayou into a paved street, from Travis to Smith sts. Cy. Engr. Dormant.

Crookston, Minn.—The construction of 15 blocks of asphalt, 5 blocks of tar macadam, and 15 blocks of gravel paving is contemplated.

Sheboygan, Wis.—The city council passed an ordinance April 19, providing for paving 4 streets with brick and 6 streets with macadam.

Los Angeles, Cal.—An ordinance is pending ordering the Los Angeles-Pacific Company to pave portions of Sunset boulevard. Cy. Engr. Hamlin.

Buffalo, N. Y.—(Special). The budget for the expenses of this city during the next year contains $250,000 for the repair of asphalt pavements.

Mt. Vernon, Ill.—Vitrified brick paving is contemplated for 7th st. B. C. Wells, engr.

Marengo, Ia.—The construction of a model dirt road across the State is contemplated.

Centerville, Ia.—The construction of 2

mis. more of paved streets is contemplated.

Waukegan, Ill.—Paving is contemplated for County st., between Washington and Water sts.

Le Mars, Ia.—Concrete paving is contemplated in alleys running east and west in block 6.

Paulsboro, N. J.—Will vote June 7 on the issue of $7,000 street improvement bonds.

Penn Yan, N. Y.—This city voted, April 12, to pave Elm st., from Main to Kenke sts.

Excelsior Springs, Mo.—City council has passed a resolution for paving Kansas City ave.

Warsaw, Ind.—Resolutions have been introduced providing for paving about 3 mis. of streets.

Le Roy, N. Y.—The town board has set aside $6,649.74 for improving the highways this year.

Ft. Wayne, Ind.—Resolutions have been adopted for paving John st., Maumee ave. and certain alleys.

Dalton, Ga.—This city will vote May 14 on the issue of bonds for paving, water, lights, sewers, etc.

South Bend, Ind.—The city council decided, April 18, to pave Mill st., from Water st. to the Lake Shore tracks.

Marshalltown, Ia.—Council will take action May 11 on 17 blocks of concrete and 30 blocks of brick paving.

Marshalltown, Ia.—Plans are being prepared for 41,000 sq. yds. of brick paving. F. B. Wiley, cy. engr.

Watseka, Ill.—Plans are being prepared for paving 3rd and 5th sts. with macadam. G. C. Houston, cy. engr.

Marshalltown, Ia.—Plans are being prepared for 19,400 sq. yds. of concrete paving. W. Steiner, cy. engr.

Houston, Tex.—Shell and gravel will be used in improving about 72 mis. of new paved roads this year. Co. comrs.

Binghamton, N. Y.—A hearing will be held May 9 on the proposed brick paving in Court st., plans and specifications for which have been adopted.

Manchester, Ia.—Cement paving is proposed for Franklin st.

Albert Lea, Minn.—The construction of concrete curbs and paving in Pearl, College, Euclid and Washington sts. and Adams av. is contemplated.

Little Rock, Ark.—Petitions for paving Main st. with brick or creosoted wood blocks will be circulated soon.

Newark, N. J.—Ordinances have been passed for paving Ridge st. and 6th ave. with brick, and grading, curbing and flagging 3rd and Bloomfield aves.

Irvington, N. J.—The town council deferred action, April 19, on the petition to pave Avon ave., from Springfield ave. to the Newark city line.

Muscatine, Ia.—The farmers on Burlington road, below this city, are planning to construct a road and pave it with brick for a distance of 6 mis.

Arkansas City, Kans.—Petitions will be circulated among the farmers in Cowley county to construct about 14 mis. of road between this city and Winfield.

Darlington, S. C.—A petition is being circulated asking the city council to call an election to vote on the question of issuing bonds for street improvements.

Plymouth, Ind.—Eldridge Thompson, engineer, and Quincy Crane and John Berg, viewers, estimate the cost of macadamizing 4 mis. of the Michigan road at $31,107.06.

Morris, Ill.—Estimates of the proposed cost of paving are as follows: W. Jefferson st., $15,083.76; Jefferson st., from Wauponsee to Pinse sts., $9,340.73; Main st., $15,224.04.

Richmond, Ind.—The city engineer has been directed to prepare plans for paving N. 10th and S. 14th sts. with tarvia binder, and bids will be asked soon. Homer Hammond, chmn. B. P. W.

Indianapolis, Ind.—The cy. engr. is preparing plans for opening streets, constructing cement walks and curbs, permanent roadways, gravel roadways, resurfacing improved streets, etc.

Shawnee, Okla.—(Special.) Frank D. Browne, cy. engr., says resolutions have been passed for paving about 15 mis. of streets, at a cost of nearly a million dollars. F. D. Stearns, mayor.

Owensboro, Ky.—The fiscal court has granted permission to Jas. Thompson, of Louisville, president of the Glenmore Distillery Co., to build an asphalt road from the city limits to the distillery plant, on the Hardinburg road.

Mishawaka, Ind.—The city clerk has been directed to ask for bids for constructing grade, walks and curbing in W. 2nd and Elizabeth sts. A resolution has been passed to construct sidewalks and curbing in 10th and 11th sts.

Dallas, Tex.—Specifications have been adopted and bids will be asked for paving Elm st., between Market and Eway, with brick, bitulithic or bois d'arc blocks. Objections will be heard May 16 and 18 for the proposed paving of Highland st. and East Side ave., respectively.

Marshalltown, Ia.—The city council will leave May 2 on a paving inspection trip that will include Fond du Lac, Wis., and Minneapolis and St. Paul, Minn. Mayor Ingledue.

Buffalo, N. Y.—(Special). Plans are to be drawn by the commissioner of public work for paving Grant st. from Hampshire st. to Forest ave.; Ledger st. from Hertel ave. to Troost st.

Cincinnati, O.—New specifications are being made for street paving work, which will be examined by J. W. Howard, paving expert of New York City, who made a recent exposure regarding the paving specifications in this city, before the Associated Organizations of Business Men's Clubs.

Red Oak, Ia.—(Special). The city council will consider a resolution of necessity for 36,000 sq. yds. of bituminized macadam and 10,000 ft. of concrete curb, May 16. Thos. S. De Lay, of Creston, Ia., has been appointed engineer in charge and desires the addresses of manufacturers of manhole covers and other municipal castings.

CONTRACTS TO BE LET.

Rome, N. Y.—Bids are asked until May 4 for paving Stanwix st. and Floyd ave. B. P. W.

Goshen, Ind.—Bids are asked until May 2 for paving S. Main st. with brick. Mayor Spohn.

Versailles, Ind.—Bids are asked until May 3 for constructing 3 macadam roads. Nicholas Volz, co. audt.

Superior, Wis.—Bids are asked until May 5 for macadamizing Stinson ave. George E. Rolph, chm. B. P. W.

Westfield, N. J.—Bids are asked until May 16 for street improvements. Lloyd Thompson, town clk.

Cincinnati, O.—Bids are asked until May 13 for improving the Coney road. Fred Dreihs, clk. co. comrs.

Brownstown, Ind.—Bids are asked until May 3 for constructing a gravel road. H. W. Walker, co. audt.

Greencastle, Ind.—Bids are asked until

May 2 for constructing a gravel road. D. V. Moffett, co. audt.

Vincennes, Ind.—Bids are asked until May 3 for constructing gravel roads. John T. Scott, co. audt.

Huntington, Ind.—Bids are asked until May 3 for constructing a gravel road. Lemuel Colbert, co. audt.

Williamsport, Ind.—Bids are asked until May 6 for constructing a gravel road. Robt. L. Winks, co. audt.

Danville, Ind.—Bids are asked until 10 a. m., May 2, for constructing 2 roads. W. H. Nichols, co. audt.

Monticello, Ind.—Bids are asked until May 3 for constructing 4 gravel roads. John T. Scott, co. audt.

Brazil, Ind.—Bids are asked until May 6 for constructing 3 gravel roads. J. L. Burris, co. audt.

Logansport, Ind.—Bids are asked until May 3 for constructing a macadamized road. Geo. W. Cann, co. audt.

Valparaiso, Ind.—Bids are asked until May 3 for constructing macadam roads. Stephen P. Corboy, co. audt.

Long Beach, Cal.—Bids are asked until May 30 for paving Railway, American and Appleton sts. B. P. W.

Kentland, Ind.—Bids are asked until May 23 for constructing a system of macadam roads. E. R. Bingham, co. audt.

Wabash, Ind.—Bids are asked until May 3 for constructing gravel and macadamized roads. J. P. Noftzger, co. audt.

Kokomo, Ind.—Sealed bids are asked until May 3 for constructing gravel roads. A. B. Easterling, co. audt.

Crown Point, Ind.—Bids are asked until 12 m., May 2, for constructing 3 gravel roads. C. A. Johnson, co. audt.

Ft. Dodge, Ia.—Bids are asked until May 2 for constructing 54 blocks of asphalt paving. Cy. clk. Tany.

Buffalo, N. Y.—Bids are asked until May 4 for paving and repairing sundry streets. Francis G. Ward, comr. pub. wks.

Normal, Ill.—Bids are asked until May 5 for paving Main st. with brick on concrete base. J. H. Keys, cy. clk.

Indianapolis, Ind.—Bids are asked until May 6 for grading and graveling Eastern ave. C. A. Schroder, prest. B. P. W.

Madison, Ind.—Bids are asked until May 3 for constructing 6.64 mis. of gravel road. Gaylord F. Crozier, co. audt.

Bloomfield, Ind.—Bids are asked until May 3 for constructing a gravel and macadamized road. Peter M. Cook, co. audt.

Kentland, Ind.—Bids are asked until May 23 for constructing a system of macadam roads. E. R. Bingham, co. audt.

Marion, Ind.—Bids are asked until May 3 for paving a street in the town of Fairmount with brick. A. Y. Stout, co. audt.

Elyria, O.—Bids are asked until May 4 for improving the Chestnut Ridge and Cowley roads. J. T. Moon, chmn. co. comrs.

Hammond, Ind.—Bids are asked until May 16 for constructing cement sidewalks in Monroe st. Adam R. Ebert, chmn. B. P. W.

Dunkirk, N. Y.—Bids are asked until May 4 for grading and paving or macadamizing Swan and Fox sts. J. M. Sackett, cy. engr.

Bloomington, Ind.—Bids are asked until May 4 for constructing a pike. Horace Blakeley, co. audt.

Grand Forks, N. D.—Bids are asked until May 6 for grading and repairing about 4 mis. of county roads. Hans Anderson, co. audt.

Anderson, Ind.—Bids are asked until May 3 for grading and paving a public highway with brick. Wm. T. Richards, co. audt.

Cleveland, O.—Bids are asked until May 14 for paving Hurbst road with Medina block stone. John F. Goldenbogen, clk. co. comrs.

South Bend, Ind.—Bids are asked until May 3 for paving St. Joseph, Navarre and Osborn sts. with asphalt. W. L. Mower, cy. engr.

Sullivan, Ind.—Bids are asked until May 4 for constructing a stone road. L. O. Turnbull, chmn. co. comrs; Ben C. Crowder, co. audt.

Columbus, O.—Bids are asked until May 10 for furnishing and placing crushed limestone screenings on Hess pike. H. K. Lindsey, co. surv.

Hammond, Ind.—Bids are asked until 10 a. m., May 2, for paving Lincoln ave. with macadam, with cement curbing. Adam R. Ebert, chmn. B. P. W.

Edwardsville, Ind.—Bids are asked until May 15 for constructing red granitoid sidewalks and brick paving in Clay st. Chas. A. Sheppard, cy. engr.

Peoria, Ill.—Bids are asked until May 9 for constructing 18,123 sq. yds. of brick paving in Garden st. Geo. F. Simmons, prest. bd. local impvts.

Jacksonville, Fla.—Sealed bids are asked until 3 p. m., May 2, for constructing sidewalks in 9 or more streets. P. A. Dignan, chmn. B. P. W.

Superior, Wis.—Bids are asked until 2 p. m., May 5, for constructing cement sidewalks in a number of streets. Geo. E. Rolph, chmn. B. P. W.

Abilene, Kans.—Bids are asked until May 10 for paving N. 1st st. with vitrified brick, bitulithic with concrete and crushed rock base, granitoid, etc.

Brookville, Ind.—Bids are asked until May 12 for constructing 2 mis. of public highway. John C. Huermann, chmn. co. comrs.; Chas. A. Miller, co. audt.

Jeffersonville, Ind.—Bids are asked until May 23 for constructing gravel roads in the counties of Clark, Scott and Jefferson. Peter Machaud, co. audt.

Elyria, O.—Bids are asked until May 4 for 7,000 sq. yds. sheet or asphalt block paving on concrete or macadam, with concrete or stone base. C. M. Theobald, cy. engr.

Salem, Ind.—Bids are asked until 1:30 p. m., May 2, for constructing Livona and Orleans road, 4,074 ft. in length. J. W. Elrod, prest. co. comrs.; G. Ellis, co. audt.

Wenatchee, Wash.—Bids are asked until May 3 for grading, curbing and paving with brick, creosoted wood block, asphalt or other suitable material. Sam R. Sumner, cy. clk.

South Bend, Ind.—Bids are asked until May 3 for paving E. Navarre st. with coal tar filled macadam or asphalt macadam. Otto C. Bostian, chmn. B. P. W.; Arthur D. Perley, cy. clk.

Janesville, Wis.—Bids are asked until May 10 for paving S. Main and Sinclair and S. 2nd sts. with brick, and S. 3rd st. with asphalt macadam. W. F. Carle, chmn. st. assmt. com.

Concord, N. H.—Bids are asked until May 6 for constructing roads, as follows: At Wilson, 6 mis. trap rock; at Winchester and Holderness, 3 mis. native stone. H. C. Hill, State engr.

Binghamton, N. Y.—Bids are asked until May 4 for paving Main st. with brick or creo-resinate wood blocks, Front st. with creo-resinate wood blocks, asphalt or brick, Washington st. with brick. Bd. contr. and sup.

Clinton, Okla.—Bids are asked until May 3 for constructing 67,000 sq. yds. asphalt paving on concrete base, 20,000

lin. ft. concrete curbing and gutter combined, 5,000 lin. ft. concrete curb, and 5,000 lin. ft. concrete gutter. C. G. Welch, mayor.

Vancourver, B. C.—Bids are asked until May 3 for paving Robson st. with wood block. Cy. clk.

La Grande, Ore.—Bids are asked until May 4 for constructing 43,920 sq. yds. of macadam paving. Cy. recdr.

Palatka, Fla.—Bids are asked until May 7 for constructing a hard surfaced road. S. Worden, secy. bd. trustees.

Davenport, Ia.—Sealed bids are asked until May 3 for paving Tremont av with Sarco mineral rubber, concrete curb, etc., and certain alleys with vitrified brick. Thos. Murray, chm. B. P. W.

Paterson, N. J.—Bids are asked until May 17 for 28,000 sq. yds. of asphalt, asphaltic macadam, Hassam, wood block and Medina block paving in Park ave.

Scranton, Pa.—Sealed bids are asked until May 24 for constructing an improved macadam road in three sections. Victor Burschel, chm. co. comrs; E. A. Jonse, controller; A. B. Dunning, road engr.

Longview, Ind.—Bids are asked until May 9 for constructing cement sidewalks in Wabash ave. with vitrified brick street and alley crossings. Harvey R. Tinsley, chm. bd. trustees town of Longview.

CONTRACTS AWARDED.

New Orleans, La.—Egans Bros. secured the contract for paving Palmyra st. for $80,275.

Los Angeles, Cal.—The contract for improving Whittier road was awarded to the Barber Asphalt Paving Co., for $99,815.63.

Duluth, Minn.—The contract for grading and graveling 6th st. was awarded to the Pastoret-Lawrence Co., for $52,024.50.

Lincoln, Neb.—The contract for paving 7th st. with Burlington brick was awarded to M. Ford, at $2.09½ a sq. yd.

Portland, Ore.—The Barber Asphalt Paving Co. was awarded the contract for paving Columbus st., at $1.44 a sq. yd.

Peoria, Ill.—A. D. Thompson was awarded a contract for paving S. Washington st., April 13, with brick, for $102,000.

Ardmore, Okla.—The Shelby Downard Asphalt Co. was awarded the contract, April 6, for paving N. Washington st. with Ardmore rock asphalt, at $1.85 a sq. yd.

San Jose, Cal.—The contract for paving E. Santa Clara st. was awarded to the Ransome-Crummey Co., at 38½ cts. a sq. yd.

Baker City, Ore.—(Special). The Warren Construction Co. was awarded the contract for 21,190 sq. yds. of bitulithic paving.

Milwaukee, Wis.—The contract for building a 600-ft. extension to Lake Drive was awarded to Wm. Gillin, for $25,000.

Mankato, Minn.—The contract for paving 2nd and Main sts. with macadam was awarded to Fielding & Shepley, of St. Paul.

Cincinnati, O.—The Citizens' Road Preserving Co. was awarded the contract for oiling the streets at 4 15-16 cts. a sq. yd.

Spokane, Wash.—The R. S. Blome Co., of Chicago, was awarded the contract for paving Washington st. with granitoid, for $28,500.

Michigan City, Ind.—The contract for paving Hermitage ave. with Metropolitan brick was awarded to W. H. Bel & Co., for $6,500.

Ft. Worth, Tex.—(Special). The contract for constructing 17,500 sq. yds. of bitulithic paving was awarded to the Texas Bitulithic Co.

Rockville, Ind.—J. L. Harvey was awarded a contract for constructing the Perry Harmless gravel road in Jackson twp., for $3,737.

Harrisburg, Pa.—The contract for paving Granite st. was awarded to the Central Construction Co., at $1.53 a sq. yd.

Miami, Okla.—(Special). The contract for constructing 27,370 sq. yds. of bitulithic paving was awarded to Pardon S. Kauil.

Normal, Ill.—The contract for paving 5 streets was awarded, April 13, to Roy L. Williams, of Cairo, Ill., for $37,077.85.

Edmonton, Alta.—(Special). The Bitulithic & Contracting Co., Ltd., secured the contract for 23,000 sq. yds. of bitulithic paving.

Memphis, Tenn.—(Special). The contract for 20,000 sq. yds. of bitulithic pavement was awarded to the Southern Granite Co., of Nashville.

Jersey City, N. J.—The contract for paving the Newark turnpike with Amiesite was awarded to Wm. J. Coughlin, at $1.24 a sq. yd.

Spokane ,Wash.—The contract for about 18 mis. of asphalt paving was awarded to J. F. Hill, of Chicago, for about $575,000.

Albany, N. Y.—(Special). T. J. Mumm, 130 Best st., Buffalo, was awarded the contract for constructing gravel roads, for $50,000.

Naperville, Ill.—The contract for paving the residence streets was awarded to the John Hayes Sons Co., of Portland, Ind., for $65,000.

Minneapolis, Minn.—The contract for surfacing the Mound road at Lake Minnetonka was awarded to Jas. F. O'Neil, for $2,100.

Collins, Miss.—The contract for constructing 2,500 ft. of concrete sidewalks was awarded to the Guaranty Paving Co., of Jackson, Miss.

Grand Forks, N. D.—(Special). The Bitulithic & Contracting Co. Ltd. was awarded a contract for 20,000 sq. yds. of bitulithic paving.

Moline, Ill.—The Northwestern Construction Co., of Davenport, was awarded the contract for paving the bluff road with brick, for 25,110.

Topeka, Kan.—(Special). The contract for 11,905 sq. yds. of bitulithic paving was awarded to the Kansas Bitulithic Co., of Kansas City, Mo.

Salina, Kas.—The contract for paving with asphalt concrete, on concrete base, was awarded to the Kaw Paving Co., of Topeka, at 1.75 a sq. yd.

Birmingham, Ala.—The contract for bitulithic paving in the 2nd and 3rd wards was awarded to the Southern Bitulithic Paving Co., for over $85,000.

Columbus, Ind.—The contract for constructing cement walks for the new city park was awarded to Harman Bros., of this city, at 6.4 cts. a sq. ft.

Ft. Worth, Tex.—The Metropolitan Construction Co. has been awarded a contract for about 2 mis. of mineral rubber paving in Lipscomb st., fo rabout $130,000.

Scranton, Pa.—The MacDonald Construction Co. secured the contract for paving Scranton and Jackson sts. and Bromley ave., with asphalt, at $1.75 a sq. yd.

Jamestown, N. Y.—The contract for 1,810 sq. yds. of bitulithic paving was awarded to Warren Bros. Co.

Perry, Ia.—The contract for 52,600 sq. yds. of bitulithic and creosoted wood block paving was awarded, April 19, to Wm. Horrabin, of Iowa City, for about $130,000.

Ellensburg, Wash.—The D. A. Williams Co., of Tacoma, submitted the lowest bid, April 13, for paving 3rd and Main sts. with brick, for $140,178.80.

St. Paul, Minn.—The contract for resurfacing Summit ave. with asphalt was awarded to the General Contracting Co., at $1.62 a sq. yd., or $53,940.20.

Aberdeen, S. D.—The contract for paving 2 mis. of streets with creosoted wood blocks was awarded to Flinn & Hanlin, of Sioux Falls, at $2.59 a sq. yd.

Portland, Ore.—(Special). The contract for 20,306 sq. yds. of bitulithic paving was awarded to the Warren Construction Co., and for 1,807 sq. yds. to the Pacific Bridge Co.

Medford, Ore.—The contract for constructing 2,000,000 sq. yds. of asphalt paving, with curbing, was awarded to the Clark & Henry Construction Co., of Sacramento, Cal., for about $500,000.

Atlantic City, N. J.—The contract for 8,300 sq. yds. of bitulithic paving was awarded to the United Paving Co., and the contract for 6,700 sq. yds. of bitulithic paving was secured by E. L. Bader.

Pittsburg, Pa.—Contracts for paving were awarded, April 5, as follows: Coltart Square, Barber Asphalt Paving Co., $12,139; Hallock st., Opp Bros., $8,786; Labelle st., Thomas Cronin, $4,857.

Louisville, Ky.—Contracts were awarded, April 4, for vitrified brick paving, to the Staebler Co., G. W. Goswell and the Jefferson Construction Co., at prices ranging from $1.79 to $1.87 a sq. yd.

St. Joseph, Mo.—The Rackliffe & Gibson Construction Co. has been awarded a contract for paving Grand ave., for $20,-512, as follows: Hassam paving, 12,000 sq. yds.; curbing, 3,000 lin. ft.; sidewalk, 10,000 sq. ft.

Jonesboro, Ark.—The lowest bids for paving and sidewalks submitted April 17 were as follows: Vitrified brick paving, J. A. Kooms, of Mt. Vernon, Il., $43,-580.10; sidewalks and curbing, Noah Bogard, of Washington, Ind., $13,006.25.

Elkhart, Ind.—The contract for paving 1 block of Boner st. with tarvia-macadam was awarded, April 13, to the Andrews Asphalt Paving Co., of Hamilton, O., at $1.06 a sq. yd. for macadam; 44 cts. a lin. ft. for curb and gutter: Total, $1,781.42.

Aberdeen, Wash.—The Barber Asphalt Paving Co. was awarded a contract for paving Market st., for $34,191.

The Dalles, Ore.—The Warren Construction Co. was awarded a contract for paving 3rd st., at $1.90 a sq. yd.

Seattle, Wash.—Paving contracts have been awarded as follows: Paving Montlake boulevard, P. J. McHugh, $23,156.48; W. Blaine st., et al., F. McClelan & Co., $67,556.77.

Houston, Tex.—Bids were submitted April 20 for paving 35½ miles of county roads, as follows: Webster air line road, 18 miles in length, running from a junction with the Harrisburg road south of Harrisburg to the Galveston county line, W. H. Hipp, $59,540; Suderman, Dolson Co., $61,542; Texas Grading Co., $67,-341; W. D. Haden, $69,460; M. C. Otto, $75,440. The specifications call for all shell material on this road. La Porte and Seabrook road, two and one-half miles in length, running from a connection with the La Porte shell road toward Seabrook, W. S. Hipp, $9,350; W. D. Haden, $10,-725; A. C. Workman, $11,310; Texas Grading Co., $11,549. Lynchburg and Crosby road, three miles in length, to be paved with clam shell and being extension of the present pavement, M. O Otto, $16,-790; John Farmer, $17,875; Texas Grading Co., $19,110; R. V. Tompkins, $19,110. Main street road, to be paved with gravel and shell for a distance of eight miles from the terminus of present pavement, W. S. Hipp, $32,960; Texas Grading Co., $36,280; L. R. Davis, $37,295. Westheimer road to be paved with gravel and shell for a distance of four miles from the end of present pavement, Texas Grading Co., $16,876; L. B. Davis, $18,720; W. S. Hipp, $19,312.

Peoria, Ill.—The contract for 3,800 sq. yds. of brick paving and 1,900 ft. of curbing in Buena Vista ave. was awarded to Jansen & Zoeller, of this city, April 15, for $6,251. The Illinois Cement & Construction Co., of Springfield, secured the contract for paving an alley with brick, for $807.

Peoria, Ill.—John W. Bushnell has been awarded contracts for resurfacing streets with asphalt as folows: Seventh ave., $12,036.70; Hamilton st., two contracts, $8,204.10 and $3,354.20 respectively; N. Jefferson st., $28,802.

Decatur, Ind.—Contracts for constructing four macadam roads have been awarded as follows: Hamlin st., grading, to S. Normile, at $11,350; 25th ave., North, grading, to S. Normile, $5,673; Melrose ave., North, paving, to Barber Asphalt Paving Co., $41,722; Nagle pl., asphalt paving, to Barber Asphalt Paving Co., $1,387; 12th ave., Northwest, grading, to J. T. Donaldson & Co., $10,465; Lafayette ave., grading, to N. D. Johnson, $14,040.

Dayton, O.—Bids were submitted April 4 for furnishing 8 carloads of asphalt for the city repair and construction work as follows: California Asphalt and Sales Agency, $28; Globe Asphalt Company, $32.50; the Warren Chemical Manufacturing Co., $28.60; the Barber Asphalt and Paving Company, $23.85; the American Asphalt and Rubber Company, $20.50.

Buffalo, N. Y.—Bids for paving four streets and an alley were submitted April 7 as follows: Linwood ave., asphalt, German Rock Co., $19,520; brick, L. H. Gipp, Constantine Construction Co., both at $16,500. Pine st., asphalt, Barber Co., 3,207; sandstone, F. V. E. Bardol, $5,900; brick, F. V. E. Bardol, $4,400. Abbey st., asphalt, German Rock Co., $19,920; brick, Constantine Construction Co., $16,000. Beacon st., asphalt, German Rock Co., $14,880; brick, Constantine Construction Co., $12,000. De Rutte alley, asphalt, German Rock Co., $1,166; brick, F. V. E. Bardol, $1,000; sandstone, F. V. E. Bardol, $1,250.

Louisville, Ky.—Contracts for reconstruction work have been awarded as follows: Barber Asphalt Paving Co., reconstructing Broadway, Walnut and Chestnut sts. and Barrett ave., $63,000; American Standard Asphalt Co., reconstructing Park and York sts., $6,600; S. L. Caxton Co., Richmond, Ind., asphalt reconstruction in 3rd ave., $32,000; American Standard Asphalt Co., original construction, Keats, Slaughter, Hillcrest and Grand aves., $32,000; L. R. Figg, original vitrified brick construction, Page and Walkins sts., $5,500; G. W. Gosnell Co., original vitrified brick construction, Preston court and Goss ave., $21,500.

Vicksburg, Miss.—Bids for paving Cherry st. were submitted, but the contract not let, April 18, as follows: Hot Spring Construction Co., brick, $86,919.06; wood block, $99,405.76; concrete, $79,-419.41; the Stevens Construction Co., brick, $90,494,85; asphalt, $88,603.95; concrete, $79,099.45; Barber Asphalt Co., $83,-915.35; Southern Bithulithic Co., $90,-380.65; Dunn & Lallande, brick, $89,-024.08; wood block, $105,429.08; South-

ern Paving & Construction Co., brick, $87,362,45; asphalt, $82,291.50.

Albany, N. Y.—Contracts for improving the public highways of state aid were awarded, April 5, as follows: Highway No. 683, Dryden-Cortland, Tompkins county, 3.57 miles; awarded to James McCormick, of East Providence, R. I., for 38.444; No. 801, East Rushford-Gordonville bridge, Allegany county, 4.68 miles; to Northwestern Construction Co., Franklin, Pa., $43,017; No. 787, East End, Otsego county, 0.47 miles; Charles E. Townsend, Oneonta, $5,700; No. 850, Canton-Corning, Steuben county, 6.15 miles; Northwestern Construction Co., Franklin, Pa., $61,263. No. 5,047, Watkins-Montour Falls, Schuyler county; McGuery, McGuigan & Baum Construction Co., Elmira, $23,043; No. 5,048, Lowman-Waverly, part 1, Chemung county; McGuery, McGuigan & Baum, Elmira, 35,310; No. 834, Kirkwood-River, Broome county; T. H. Gill Co., Boston, Mass., $75,676; No. 5,415, Deposit-Hales Eddy, Delaware county; Almahar Construction Co., Albany, $46,764; No. 5,046, Scottsville-Mumford, Monroe county; Monroe Roads Co., Pittsford, $57,906; No. 854, Castile Center-Perry Center, Wyoming county; Greece Construction Co., Rochester, $54,-925; No. 740, Sanborn-Pekin, Niagara county; Louis H. Gipp Co., Buffalo, $26,-950; No. 715, Dansville-Mount Morris, part 2, Livingston county; Northwestern Construction Co., Franklin, Pa., $55,792; No. 5,054, Eighteen-mile creek, Erie county; Frederick J. Mumm, Buffalo, 28,000; No. 857, Roberts road, Chautauqua county; county of Chautauqua, by W. L. Notally, $32,485; No. 852, Meridian village, Cayuga county; Alfred Gaffey, Syracuse, $11,-800; No. 664, Otselic-South Otselic, part 1, Chenango county; Joseph McCormack, East Providence, R. I., $43,188; No. 811, Georgetown-Otselic, Madison county; Joseph McCormack, $23,749; No. 5,041, Luna-East Bloomfield, part 2, Ontario county; Charles O. McComb, Syracuse, $34,500; No. 5,044, Mexico-Union Square, part 1, Oswego county; Cunningham & Woodward, Hudson Falls, $38,639.

Ft. Wayne, Ind.—Bids were submitted April 15 for paving as folows: The paving of Berry st., Barber asphalt Co., for Trinidad sheet asphalt, per lin. ft., $9.09; Moellering Construction Co., for Metropolitan block (brick), 6.45; for creosote block, $9.82; paving of Division st., Barber Asphalt Co., for Trinidad sheet asphalt, per lin. ft., $8.06; Derheimer & Sons, for Bessemer repressed brick, $8.29; Trippeer & Sons, for Bessemer or Metropolitan block, $8.22; Moellering Construction Co., for Metropolitan or other block, $8.31; Oscar Menefee, for Metropolitan block, $8.18; paving of Harner street, Derheimer & Sons, for Bessemer repressed block, per lin. ft., $6.85; Moellering Construction Co., for Metropolitan or other block, $7.13; paving of Pontiac st., Moellering Construction Co., for Metropolitan block paving, per sq. yd., $1.50; excavation per cu. yd., 45 cents; curb, per lin. ft., 60 cents; Derheimer & Sons, for Bessemer block, $1.56; excavations, 40 cents; curb, 50 cents; Tripper & Son, for Metropolitan or Bessemer block, 1.45; excavation, 40 cents; curb 55 cents. Ed Grosjean secured the contract for constructing cement sidewalks in High st. at 10⅝ cts. a sq. ft.

Macon, Ga.—Bids were submitted April 19 for paving the streets as follows: Georgia Engineering Co., granite block, 6-in. foundation, $2.08; 4-in. foundation, $2.57; 5in. foundation, $2.63; brick, 6-in., foundation, $2.08; 4-in., $1.93; 5-in., $2; wooden blocks, 6-in., $2.65; 4-in., $2.53; 5-in., $2.58; W. J. Beeland, Macon, granite block, 6-in., $2.71; 4-in., $2.60; 5-in., $2.49; wooden blocks, 6-in., $2.97; 4-in., $2.75; 5-in., $2.68; Barber Asphalt Co., asphalt, 6-in., $1.86; 4-in., $1.65; 5-in., $1.97; bitulithic, 6-in., $1.10; 4-in., $1.08; 5-in., $1.77; Atlantic Bitulithic Co., Richmond, Va., bitulithic, 6-in., $2.32; 4-in., $2.12; 5-in., $2.20; C. W. Lane Co., Atlanta, granite block, 6-in. foundation, $2.32; 4-in., $2.17; 5-in., $2.24; brick, 6-in., $1.94; 4-in., $1.79; 5-in., $1.86; wooden blocks, 6-in., $2.38; 4-in., $2.23; 5-in., $2.30; brick, with pitch filler, 8c per sq. yd., additional; Jamison & Hollowell; granite blocks, 6-in. foundation, $2.66; 4-in., $2.56; brick, 6-in., $2.23; 4-in., $2.05; 5-in., $2.12; wooden blocks, 6-in., $2.57; 4-in., $2.39; 5-in., $2.47; Hassam concrete, 6-in., $2.73; 4-in., $1.86; Hall-Parker Construction Co.: brick, 6-in. foundation, $2.23; 4-in., $2.03; 5-in., $2.13; wooden blocks. 6-in., $2.51; 4-in., $2.31; 5-in., $2.41; McPoland & O'Gara, Birmingham, Ala., wooden blocks, 6-in. foundation, $2.49; 4-in., $2.28; 5-in., $2.38; Rudolph S. Blome Co., Chicago, granitoid, 5-in. foundation, $2.04; W. M. Lasley, Chattanooga, granite blocks, 6-in. foundation, $2.28; 4-in., $2.12; brick, 6-in., $2.08; 4-in., $1.95; 5-in., $1.99; wooden blocks, 6-in., $2.29; 4-in., $2.12; 5-in., $2.21.

SEWERS.

CONTEMPLATED WORK.

Union City, Ind.—The sewerage system will be extended.

Ferndale, Wash.—A sewerage system is contemplated.

Sparta, Wis.—A sewer in Water st. is contemplated.

St. Paul, Neb.—This city voted to construct a sewerage system.

Miles, O.—Plans for constructing sewers are being prepared. B. P. S.

Madison, S. D.—This town may vote on installing a sewerage system.

Silver Lake, N. J.—A sewerage system is urged for this town.

Lebanon, Ind.—Plans for a sanitary sewer have been adopted.

South Haven, Mich.—Council has approved the construction of 4 new sewers.

Laurel, Mont.—This city to issue bonds for constructing a sewerage system.

Chehalis, Wash.—A sewer district is to be established here to cost $80,000.

Greenville, S. C.—This city voted to issue $40,000 bonds for sewer construction.

Canton, O.—A sewage disposal system will be installed here. J. A. Starret, cy. engr.

Princeton, Ill.—Surveys have been completed for a sewer system in the South End.

Irondale, Wash.—The construction of a temporary sewer in Moore st. is contemplated.

New Westminster, B. C.—Plans have been completed for constructing 20 mis. of sewers.

Corydon, Ia.—This city voted to issue bonds for the construction of a sewerage system.

Grand Haven, Mich.—Plans for constructing sewers in various streets have been accepted.

Whitefish, Mont.—This city voted to issue $10,000 bonds for constructing a sewerage system.

Texarkana, Ark.—A new sewerage district has been created in the northern part of this city.

Poteau, Okla.—This city voted to issue $40,000 for constructing a sewerage system. Mayor.

Missouri Valley, Ia.—Plans for a sewerage system have been completed, estimated cost $78,600.

Lowell, Mass.—The city council voted to obtain a loan of $50,000 for constructing sewers.

Providence, R. I.—An ordinance has been adopted providing for an issue of $400,000 sewer bonds.

Mishawaka, Ind.—A resolution has been passed to construct a sewer in Grove and E. Joseph sts.

Cincinnati, O.—An ordinance has been passed providing for the construction of a sewer in Elm ave.

Seneca, Kans.—Bids will be asked about June 1 for installing a sewerage system. C. H. Herold, cy. clk.

Warren, O.—Bids will be asked for soon for constructing a trunk sewer in White and Dickey run. B. P. S.

Columbus Junction, Ia.—The business men have been agitating the question of constructing a sewerage system.

North Tonawanda, N. Y.—Plans have been completed for a sewer system in the Rumbold ave. district of North Tonawanda.

Erwin, Tenn.—The construction of about 4 mis. of sanitary sewers is contemplated. Wm. Dunlap, engr., Johnson City, Tenn.

Beeville, Tex.—This city voted to issue $30,000 bonds for constructing a sewerage system, and a contract will be let soon.

Tacoma, Wash.—The citizens voted April 5 to issue $100,000 bonds for constructing 3 storm water sewers. W. C. Raleigh, cy. engr.

South Pasadena, Cal.—Plans for a sewerage system have been prepared by Olmstead & Gillillen, of Los Angeles.

North Amherst, O.—Plans for a sewerage system and disposal plant will be made by L. E. Chapin, of Canton.

Herington, Kans.—Plans are being prepared for installing a sewerage system. Burns & McDonnell, engrs., Kansas City, Mo.

Prairie du Chien, Wis.—Plans for a sewerage system will be made by W. G. Kirchoffer, of Madison. Eugene Amann, cy. clk.

Garnett, Kans.—Plans have been completed and bids will be asked for constructing a sewer. M. D. Pelkington, cy. clk.

Williamson, W. Va.—(Special). Claude L. Gaujot, engr., advises us that the extension of the sewerage system is contemplated.

Ada, O.—Plans will be prepared soon by Thos. Small, vil. engr., for installing a concrete sewer in this country. Elmer J. Carey, co. audt.

Indianapolis, Ind.—The question of constructing a sewage disposal plant will be considered this year.

Colfax, Ia.—Plans and specifications for 11,200 ft. of sewer will be made for this city by Engineer Watkins, of Iowa City.

Chicago, Ill.—A new drainage district has been created in the North Side along North Park ave. and a sewer will be constructed.

Houghton, Mich.—Plans for new sewers in 4 districts have been prepared by cy. engr. Crary, and objections will be heard May 4.

Ft. Wayne, Ind.—The construction of a main sewer and branches in Cottage and Beaver aves. is contemplated. F. M. Randall, cy. engr.

Columbus, Ind.—Council has ordered the construction of a new sewer to be known as the Maple Grove sewer, at a cost of about $29,000.

Newark, N. J.—Ordinances have been passed for constructing sewers in Frelinghuysen ave. Wm. E. Greathead, clk. bd. st. and water comrs.

Asheville, N. C.—Cy. Engr. Lee is preparing plans and specifications and will ask for bids for constructing a sewerage system in the East End.

Oroville, Cal.—Cy. Engr. Randall, of Sacramento, and Prof. Hyde, of the University of California, will supervise the construction of a sewerage system here.

Oshkosh, Wis.—Plans for constructing sewers in Durfee and other streets have been prepared. Sewers will also be built in 16th and other streets.

Brookfield, Ind.—(Special). Plans and specifications for a storm and sanitary sewer system are being made by John Finan. Bids will soon be asked.

Indianapolis, Ind.—New specifications for street and sewer improvement have been completed and bids for their construction will probably be asked about May 1.

Austin, Tex.—State health officer Brumby and Mark Hanner, sanitary engineer, visited San Antonio about April 15 to investigate sewerage system of that city.

Bellefontaine, O.—Plans have been completed and bids will be asked for about June 1 for constructing a sewerage system and disposal plant. C. A. Inskeep, cy. engr.

Ligonier, Pa.—(Special). Ira F. Brant, clk., advises us that F. H. Shaw, of Lancaster, Pa., has been engaged to prepare plans for a sewerage system and sewage disposal plant.

Roseville, Cal.—Plans and specifications have been submitted for constructing a modern sewerage system for the entire city, and the question of issuing bonds will be voted on.

Beloit, Wis.—Plans and surveys for a new sewer district in the northeast part of this city will be made by Geo. W. Sturtevant, of Chicago. A purification plant may also be erected.

Winnetka, Ill.—The construction of a sanitary sewer in the northwestern part of this city and storm sewers in sundry streets is contemplated. S. P. Greeley, prest. bd. local impvts.

Buffalo, N. Y.—(Special). Francis G. Ward, comr. pub. wks., has ordered plans prepared for constructing sewers in Argus st. between Roesch ave. and O'Neil st., west side of Franklin st., between Genesee st. and Chippewa st.

Belton, Tex.—The Belton Sanitary Sewerage Co. has been organized by Dr. J. M. Frazier, Rev. S. G. Townsend, C. B. Smith, C. F. Denny and J. W. Jarrell. A charter will be applied for and a sewerage system constructed.

Lenox, Mass.—Wm. S. Johnson, of Boston, has completed a report on sewers, and recommends an expenditure of $29,300 for 2 mis. of new sewers, extending the main sewer, constructing settling tanks, sludge beds, and filter beds.

Paterson, N. J.—A bill has been signed by Governor Fort, authorizing the Passaic Valley Sewerage Commission to contract with the U. S. government for the discharge of the Passaic Valley sewage into New York Bay at Robbins' Reef.

CONTRACTS TO BE LET.

Blaine, Wash.—Bids are asked until May 16 for constructing a sewer. Cy. clk.

Marion, Ind.—Bids are asked until May 7 for constructing Duckwell ditch. D. M. Murphy, supt. constr.

Mandan, N. D.—Bids are asked until May 9 for constructing a sewerage system. Lee Nichols, cy. audt.

Jackson, Tenn.—Bids are asked until May 3 for constructing sanitary sewers. Atwell Thompson, cy. engr.

Cumberland, B. C.—Bids are asked until May 4 for constructing certain sewerage works. Cy. clk.

Greenfield, Ind.—Bids are asked until May 4 for constructing a drain. V. A. Smith, drainage comr.

Wenatchee, Wash.—Bids are asked until 5 p. m., May 3, for constructing pipe sewers. S. R. Sumner, cy. clk.

South Bend, Ind.—Bids are asked until May 3 for constructing a pipe sewer in E. Broadway. A. P. Peerley, clk.

Bay City, Tex.—Bids are asked until May 10 for constructing drainage district No. 3. A. R. Leckie, engr. in charge.

Manhattan, Kan.—Bids are asked until 3 p. m., May 3, for constructing a complete sanitary sewerage system. A. W. Long, mayor.

Baltimore, Md.—Bids are asked until May 4 for constructing sec. 2 of the Jones Falls interceptor. C. W. Hendricks, ch. engr.

Perth Amboy, N. J.—Bids are asked until May 21 for constructing a 12 ft. sewer in Baker place. Geo. M. Adair, st. comr.

York, Pa.—Bids are asked until May 9 for constructing terra cotta sewer mains, flush tanks, manholes, etc. Harry Washers, chm. B. P. W.

Brainerd, Minn.—Bids are asked until May 11 for constructing lateral sewer "L" in sewer dist. No. 1. V. N. Roderick, cy. clk.

St. Paul, Minn.—Sealed bids are asked until May 18 for constructing state ditches. Samuel G. Iverson, state audt; Geo. A. Ralph, state drainage engr.

Westfield, N. J.—Bids are asked until May 16 for constructing 11,600 ft. 8 in. sanitary sewers, 21 manholes, 460 branches, 10 combined flush tanks, etc. Lloyd Thompson, town clk.

Belzoni, Miss.—Bids are asked until May 17 for constructing a system of house sewers 3 to 4 mis. of 8 and 10 in. pipe sewers, centrifugal pump and motor. Mayor and aldermen. Walter G. Kirkpatrick, cons. engr., Jackson, Miss.

Davenport, Ia.—Bids are asked until May 3 for constructing sewers. Thos. Murray, cy. engr.

Paterson, N. J.—Sealed bids are asked until May 17 for constructing the Lake View sewer, including 2,660 ft. of 36 in., 1,140 ft. 30 in., 2,500 ft. 24 in., 1,400 ft. 18 in., 600 ft. 13 in., and 1,300 ft. 10 in. pipe and 6,800 ft. 6 in. house connections. H. J. Harder, cy. engr.

CONTRACTS AWARDED.

Everett, Wash.—Lower & Eckstrom secured a contract for a sewer in an alley for $1,876.

Indiana, Pa.—J. J. McGovern was awarded a contract for constructing the Normal school sewer.

Dallas, Tex.—C. W. Olcott secured a contract for constructing a sanitary sewer in Cochran st.

Oakland, Cal.—W. J. Schmidt was awarded a contract for sewer work in Broadway, for $1,605.75.

Hamburg, Ia.—The contract for constructing sewers was awarded to Dunnegan & Corey, of Shenandoah, for $8,180.52.

Ventnor, N. J.—The contract for constructing a large pipe sewer was awarded to Lemuel Henry, April 7, for $20,000.

Akron, O.—The contract for constructing the Bartges st. storm sewer was awarded to McAlonan Bros. for $8,254.

Hamburg, Ia.—The contract for constructing sewers was awarded to Dunnegan & Corey, of Shenandoah, for $8,181.

Dayton, O.—John Wise was awarded the contract for constructing a storm water sewer in Springfield st., for $3,254.80.

Eveleth, Minn.—The contract for installing a storm sewer was awarded to the Pastoret-Lawrence Co., Duluth, for $2,400.

Moline, Ill.—The Moline Heating and Construction Co. was awarded the contract for building a sewer in Eighteenth and-One-Half st., for 1,540.

Monroe, Wash.—The contract for instaling a sewerage system was awarded to the Evertt Construction Co., of Everett, Wash., for 12,689.

Galesburg, Ill.—Mart O'Connor was awarded a contract for constructing sewers in Kellogg, Cherry, 5th and Seminary sts., April 12, for 8,832.

Belton, Tex.—The Fountain-Shaw Engineering Co., of Dallas, was awarded a contract for constructing a system of sewers for the Belton Sanitary Sewer Co.

Palestine, Tex.—The contract for constructing 4 mis. of mains of mains for the Palestine Sewer Co. was awarded to Truehart & Jockson, of San Antonio.

Rochester, N. Y.—The contract for building a sewer in Dewey ave. and several adjacent streets has been awarded to Brayer & Albaugh, for $68,661.10.

Burlington, Wis.—The contract for constructing sanitary and storm sewers and water works extensions was awarded to Herman Hohensee, of Milwaukee.

Rock Island, Ill.—The contract for constructing sewer and water mains in Krells addition was awarded, April 18, to P. F. Trenkenschuh, for 3,420.

Tulsa, Okla.—H. C. Cass & Co. was awarded the contract for constructing 1,166 ft. of combination storm and sanitary sewer in W. 1st st., for $13,268.

Abilene, Kans.—The contract for constructing a storm sewer in Chestnut and S. 1st sts. was awarded to contracting engineer Underwood, of Houston, for $14,-831.72.

Michigan City, Ind.—H. W. Bell was awarded a contract for constructing the Wilard ave. district sewer, for $39,833, and for the Tryon district sewer, for $5,668.

Ada, Okla.—The contract for constructing 10,150 lin. ft. of sanitary lateral sewers in district 3 with appurtenances, was awarded to Gilkerson & Lecy, of Muskogee, for $8,128.

San Francisco, Cal.—The Healy-Tibbits Constr. Co. was awarded a contract for constructing the Yerba Buena sewer, which is to provide an outlet for the sewage in the district bounded by Market, 2d Howard and East sts., for $211,000.

Peabody, Kans.—(Special). J. W. Mavity, cons. engr., Lyndon, Kans., advises us that the contract for constructing 4 mis. of main and lateral sewers and 1 reinforced septic tank in this city, was awarded April 15 to Marshall Bros., of Los Animas, Colo., for $17,066.59.

Logan, Ia.—The contract for constructing sections 1, 2 and 3 of the Upper Bayer river drainage district was awarded to the Canal Construction Co., of Chicago, at 6 8-10 cts. a cu. yd. J. B. Norris, of

Logan, secured the contract for section 4, consisting of the removal of the dam and other stream obstructions.

Columbia, Wis.—Bids for constructing tile and earthenware sewers was awarded April 5 as follows:To Columbia Paving Co. for sewers 30, 31 and 33, $14,039, and to C. A. Stewart for sewer 28 at $4,261.

Minneapolis, Minn.—Bids for furnishing this city with sewer pipe were submitted as follows: Red Wing (Minn.) Sewer Co., $62,779; Blackmar & Post Co., St. Louis, $64,552; Evans & Howard, St. Louis, $66,198.

Louisville, Ky.—Bids were submitted April 15 and taken under advisement, for constructing sewerage systems in 15th and 23d sts., as follows: Henry Bickel Company, L. W. Hancock Company, of Louisville; Gyld & Co., Chattanooga; James Ferry Company, Pittsburg, and the B. C. Miller Sons Company, of Louisville.

Richmond, Va.—Contracts for constructing sewers have been awarded as follows: Burton & Driscoll, sewer in West st. and other streets, $18,948; West Cary st., $8,428; Shepherd st, $14,371; West st., $8,426; J. C. Cheatwood, sewer in North 17th st., $6,986; I. J. Smith & Co., sewer in West Cary st., $7,717, all of Richmond.

Lawrence, Kans.—Sewer contracts have been awarded as follows: Richard Keys has been awarded contract at $1.50 per lin. ft., and 40 cts. for excavation, for the construction of a storm sewer of brick in Henry st., between Maine and Missouri sts; and Graeber Bros., at $3.75 per lin. ftfl and 25 cts. per cu- yd. for excavation for the construction of a concrete culvert in Mississippi st.

WATER WORKS.

Holland, Tex.—The Holland Water Co. has been organized and will sink an artesian well.

Humble, Tex.—The Humble Water, Light and Ice Co. has been incorporated by W. E. Sholar, C. L. Polk and E. L. Cullum.

Ardmore, Okla.—The bd. of city comrs. has instituted proceedings to condemn a tract of 160 acres in Murray county, 12 miles east of the Washita river, as a site for a water power plant.

Brownstown, Ind.—The Browntown Water and Light Co. has been incorporated to supply town, communities, etc., with water, heat, light and power, by Harley Jackson, . B. Vance, and Geo. S. Grary.

Plainfield, N. J.—The citizens voted to give common council the power to purchase by condemnation the water plant of this city, to erect a new plant, or make another contract with the Union Water Company, a private corporation.

CONTEMPLATED WORK.

Winfield, Ia.—A water works system is urged.

Plymouth, Ind.—Council has passed a water meter ordinance.

Connersville, Ind.—This city will drill a test water well.

Carson, Ia.—Will vote on the issue of bonds for a water works system.

Alma, Wis.—This town voted to construct a water works system.

Lewiston, Utah.—The construction of a water works system is contemplated.

Le Beau, S. D.—Will vote on installing a water works system.

Manchester, Ia.—This city may adopt a new water meter system.

Kennett, Mo.—This city voted to construct a water works system.

Snyder, Tex.—This city voted to issue $17,400 water works bonds.

El Reno, Okla.—Voted to issue bonds for constructing water works.

Redwood Falls, Minn.—Council has decided to construct a 4 in. main on 3d st.

Willard, Utah.—This city voted to issue $9,000 bonds for water works purposes.

Elkhart, Ind.—Means are being devised here for obtaining a better water supply.

Corydon, Ia.—This city voted to issue bonds for constructing a water works system.

Newport, Tenn.—The question of municipal water works for this town is being urged.

Gardner, Mass.—The extension of the water mains in West st., 1,000 ft. is contemplated.

South Bend, Ind.—The construction of a large number of water mains has been authorized.

Montclair, N. J.—A proposition is being discussed for establishing a municipal water plant.

Raymond, Minn.—Will vote on the issue of bonds for constructing of water works system.

Waterloo, Wis.—Voted to issue bonds for installing a municipal water works system.

Gainesvile, Ga.—This city coted to issue $100,000 bonds for the construction of water works.

Youngstown, O.—The establishment of a reservoir for a municipal water supply is contemplated.

Minneapolis, Minn.—The council water com. has ordered the construction of water mains in 25 streets.

Churchville, N. Y.—The business men are agitating the question of constructing a water works system.

Pueblo, Colo.—A committee of 25 has been appointed to investigate the proposed improvement of the water supply.

Osyka, Miss.—The construction of a water works system is contemplated and bids will probably be asked in June or July.

Saginaw, Mich.—The board of water comrs. has approved the proposed construction of new water mains this year.

Hartsell, Ala.—The installation of a water works and electric light plant is contemplated. J. H. Corsbie, mayor.

New Britain, Conn.—The board of water comrs. voted to build a reservoir on the Pierre property. Estimated cost, $20,000.

Croghan, N. Y.—A bill has been passed authorizing the village trustees to issue $29,000 bonds for constructing water works.

Pipestone, Minn.—The citizens of the independent school district voted to construct a complete water works system.

Mt. Jackson, Va.—This city voted to issue bonds for constructing a gravity system of water words. F. E. Brill is interested.

Ligonier, Pa.—(Special). Plans for enlarging the municipal water works system are being prepared by Ira F. Brant, clk.

Vicksburg, Miss.—City council is considering the purchase of the present water works system instead of constructing a system.

Grand Rapids, Mich.—This city voted April 4 to construct a filtration plant, and extend the water mains. Jas. Schriver, cy. clk.

Williston, N. D.—This city has under consideration the substitution of a system of wells instead of a settling basin at the power plant.

Pittsfield, Mass.—The water com. recommends the construction of a reservoir

on the headwaters of Mill Brook. Estimated cost, $250,000.

Niagara Falls, N. Y.—The water comrs. have decided to ask for bids for constructing a filtration plant for the new water works system.

Jackson, O.—(Special). E. C. McConnell may desire to purchase 1 hoist, 1 trenching machine, water pipe, and pumps for the water plant.

Canandaigua, N. Y.—The pumping system of this city is inadequate, and an investigation is being made with a view to installing a duplicate system.

Port Angeles, Wash.—The Port Angeles Water Supply Co. has been organized by by W. W. Seymour and associates for the purpose of constructing a new water works system.

Indianapolis, Ind.—The board of public works will, in the future, order only 400,000 ft. of mains a year, the amount the Indianapolis Water Co. is required to lay under its contract with the city.

Williamson, W. Va.—(Special). Claude L. Gaujot, cons. engr., says this city contemplates installing a purification plant for the water works system. Address all communications to Claude L. Gaujot, engr.

Harrisburg, Pa.—The state water supply comrs. held a hearing April 19, on the application of the board of public works of this city to erect a low dam across the Susquehanna river at the lower end of the city.

Dayton, O.—A special committee has been appointed to investigate the water question, ascertain the various sources of supply, and what the city is doing to secure the proper permanent supply. The members of the committee are Chas. Thomas, F. C. Marley and C. A. Brooks.

CONTRACTS TO BE LET.

Colby, Kans.—Bids are asked until May 3 for constructing a water and electric light system. C. V. Parrott, cy. clk.

Leslie, Md.—Bids are asked until June 1 for constructing a clay lined reservoir, furnishing c. i. pipe, etc. G. A. M. Johnson.

Waterbury, Conn.—Bids are asked until May 20 for constructing a concrete dam in the town of Morris. R. A. Cairs, cy. Engr.

Cherokee, Ia.—Bids are asked until 8 p. m., May 3, for constructing 1,000 ft. 6 in. c. i. water pipe and 2,200 ft. 4 in. c. i. water pipe.

Meridian, Miss.—Bids are asked until May 31 (readv.), for constructing 8,500 ft. 24 in. reinforced concrete conduit. Wm. F. Wilcox, genl. engr., water comn.

Detroit, Mich.—Bids are asked until June 14 for erecting an engine room building superstructure at the new pumping station. Benj. F. Ginney, secy. bd. water comrs.

Johnson City, Tenn.—Bids are asked until May 5 for constructing a water supply system, including 12 miles of 18 in. gravity mains and a reinforced concrete reservoir.

Atlantic City, N. J.—Bids are asked until May 3 for installing a generator, exciter, switchboards and transformers at the Abrecon pumping station. Louis Knehule, prest. water bd.

Creede, Colo.—Bids are asked until May 25 for constructing a dam and spillway at the Rio Grande reservoir site, 30 miles west of here. San Luis Valley Irrigation Dist., Center, Colo.

Breaux Bridge, La.—Bids are asked until May 3 for constructing 2,200 ft. 8 in. and 12,400 ft. 6 in. c. i. water main; 25 fire hydrants, valves, pumps, tank and tower, etc. John Comeau, cy. clk.

CONTRACTS AWARDED.

Brainerd, Minn.—The contract for installing a pump was awarded to Slipp-Greuenhagen Co., for $885.

Austin, Tex.—The contract for rebuilding the dam was awarded to the Dumont-Holmes Steel Concrete Co., of Chicago.

Colton, S. D.—J. L. White, of Sioux Falls, submitted the lowest bid for installing a water works system, at $5,985.

Ardmore, Okla.—The contract for constructing a filtration plant has been awarded to Geo. Erickson of this city, for $10,437.

Tacoma, Wash.—D. A. Williams & Co. was awarded the contract for constructing a water main district in the west end for $23,950.

Lebanon, Pa.—The concrete for constructing the new water distributing system was awarded to W. M. Chishold & Son, of Pittsburg.

Gilbert, Minn.—The contract for the extension of the water works system was awarded to Postoret & Lawrence, of Duluth, for about $11,400.

Duluth, Minn.—Contracts were awarded April 18 for constructing nearly 3½ miles of water and gas mains, at a cost of about $32,000.

Buffalo, N. Y.—(Special). The contract for installing 5 pumps in the new pumping station was awarded to the Holly Mfg. Co., for $674,769.

Bradford, Pa.—The contract for constructing a reservoir in Bradford was awarded to Wm. McIntire & Sons, of Sharon, Pa., for about $100,000.

Oakesdale, Wash.—The contract for furnishing the material for the water works system to be installed here was awarded to Crane & Co., of Spokane.

Houston, Tex.—A contract for furnishing 500 standard sapphire meters in assorted sizes has been awarded to the Standard Water Meter Co., of Brooklyn.

Winnipeg, Man.—The Canadian Fairbanks Co. was awarded the contract for furnishing hydrants at $37 each, and T. McAvity & Sons the contract for supplying valves.

South Bend, Ind.—The Glamorgan Pipe and Foundry Co., of Lynchburg, Va., was awarded the contract for furnishing 300 tons of pipe and special castings, at $25.50 per ton for pipe and $49 per ton for special castings.

Ogden, Utah.—The contract for constructing reservoir No. 2 was awarded to the Wheel Wright Construction Co., of this city, as follows: 2,050 cu. yds. concrete including forms, $7.24; 200 cu. yds. excavation, 50 cts.

Krebs, Okla.—The contract for constructing a dam in connection with the water works system was awarded to Lane & Williamson, for $16,000, and F. C. Broks & Sons Co., of Jackson, Mich., received the contract for constructing water pipe, furnishing hydrants, etc., for $21,408.

Buffalo, N. Y.—(Special). The contract for furnishing 8 750 H. P. water tube boilers for the new Porter ave. pumping station was awarded to Farrar & Trefts, for $185,000. The Monarch Engineering Co. secured the contract for coal and ash-handling equipment for 34,875.

Portales, N. M.—The contract for 2 generators to be installed in connection with the work of the Portales Irrigation Co., Portales, was awarded to the Westinghouse Electric Mfg. Co., of Pittsburg, Pa. The contract for construction work was awarded to the Western Construction Co., of Wichita, Kans., for about $350,000.

Lancaster, Pa.—Contracts were awarded April 18 for water meters to the Na-

tional Meter Co., of New York; Pittsburg Meter Co., East Pittsburg; Thomas Meter Co., Brooklyn; Neptune Meter Co., New York City; H. R. Worthington, Philadelphia. Other contracts awarded were as follows: Furnishing pipe, U. S. Cast Iron Pipe and Foundry Co., Williamsport; lead, R. W. Cummings & Co.; specials, Barry & Zecher; ferrules, H. Mueller Co., N. Y. City; excavating and hauling pipe, W. J. Hinden.

St. Louis, Mo.—Bids for water extension contracts were submitted April 19 as follows: Water pipe, Dimmick Pipe Co., $52,437; special castings, Bessemer Foundry and Machinery Co., $12,428; stop valves, Roe Stephens Manufacturing Co., $4,995; fire plugs, American Foundry Co., $17,825; laying water pipe, John O'Donnell, $8,040. The pipe laying contract includes 43,000 feet of six-inch pipe, 15,000 feet of twelve-inch main, 4,700 feet of twenty-inch pipe, the installation of 158 fire plugs, and taking up of 4,800 feet of six-inch main.

BRIDGES.

Stevenson, Wash.—Bids are asked until July 5 for constructing 2 bridges. County comrs.

Peru, Ind.—Bids are asked until May 5 for constructing 20 bridges. Chas Griswold, co. audt.

Danville, Ind.—Bids are asked until May 17 for constructing 10 bridges. W. H. Nichols, co. audt.

Jamestown, N. Y.—(Special). This city voted to construct 2 concrete brilges at a cost of $50,000.

Cedar Rapids, Ia.—Bids are asked until May 7 for erecting a new concrete steel bridge. Cy. coun.

Shreveport, La.—A wagon bridge across Red river between this city and Bossier, is contemplated.

Bungo, Minn.—Bids are asked until May 7 for constructing a pile bridge on Bungo creek. W. N. Hanley, chm. town bd.

Pendleton, Ore.—Bids are asked until May 6 for constructing 2 steel bridges. Frank Saling, co. clk.

Monticello, Ind.—Bids are asked until May 3 for constructing 3 sets of stone abutments. Chas. A. Gay, chm. co. comrs.; A. G. Fisher, co. audt.

Petersburg, Ind.—Bids are asked until May 3 for constructing 5 steel bridges. F. R. Bilderback, co. audt.

Salamanca, N. Y.—Plans are being prepared for a reinforced concrete or steel bridge. Fred Gardner, town clk.

Kokomo, Ind.—Bids are asked until June 7 for constructing a bridge across Wild Cat creek in Center township. Co. comrs.

Mt. Morris, N. Y.—The culvert over the power race on State st. is to be rebuilt. Jas. E. Kelly, resident engr.

Ypsilanti, Mich.—Bids are asked until May 16 for constructing a reinforced concrete bridge over Huron river. S. Damon, cy. clk.

Eugene, Ore.—Bids are asked until May 9 for constructing a wooden bridge over the Row river 2 mis. east of Cottage Grove.

Jacksonville, Ore.—Bids are asked until May 5 for constructing a steel bridge across Bear Creek at Phoenix, Ore., co. clk.

Linton, N. D.—Bids are asked until May 10 for constructing concrete abutments for the Petrie bridge. J. C. Pitts, co. audt.

Pittsburg, Pa.—Bids are asked until May 3 for constructing superstructure and masonry of bridge No. 1. Thompson's Run. Turtle Creek borough. R. J. Cunningham, co. contr.

Elkins, W. Va.—Bids are asked until May 6 for constructing a bridge across Cheat river. F. A. Rowan, clk of court.

Greensburg, Ind.—Bids are asked until May 14 for constructing a concrete bridge in Jackson township. John G. Evans, township trustee.

Crown Point, Ind.—Bids are asked until June 6 for constructing a concrete bridge and a steel bridge. Chas. A. Johnston, co. Audt.

Coquille, Ore.—Bids are asked until May 5 for constructing a bridge across the South Fork of the Coquille river at Herman Place. Co. clk.

Cleveland, O.—Bids are asked until May 11 for constructing a concrete culvert and conduit and a concrete bridge. John F. Goldenbogen, co. clk.

Gretna, La.—Bids are asked until June 1 for constructing a steel bridge over a canal in Jefferson Parish. E. M. Hubert, secy. police jury.

Cincinnati, O.—Bids are asked until May 6 for constructing a concrete culvert on zig zag road. Stanley Struble, prest. co. comrs.

Cheboygan, Mich.—Bids are asked until May 10 for constructing a railway bridge across the Cheboygan river. Detroit & Mackinac Ry. Co.

Wabash, Ind.—Bids are asked until May 3 for constructing a steel, a concrete bridge, arches, and bridge repairs. Blondell Perry, co. engr.

Princeton, Ind.—Bids are asked until May 4 for constructing 11 steel bridges and 14 reinforced concrete bridges. W. T. Roberts, co. audt.

Cohasset, Minn.—Bids are asked until May 3 for constructing a steel bridge with concrete abutments over the Mississippi river. E. W. Windsor, town clk.

Minneapolis, Minn.—The Security Bridge Co., was awarded a contract for constructing a bridge at Lake st. and 2 bridges at Lake of the Isles, for $80,000.

White Rocks, Utah.—Bids are asked until June 1 for constructing the substructure of a steel bridge at Uintah and Ouray Indian agency. Comr. Indian Affairs, Washington, D. C.

STREET LIGHTING.

Hempstead, Tex.—An electric light plant is contemplated.

Horse Cave, Ky.—An electric light plant is contemplated.

Miles City, Mont.—Voted to construct a municipal electric light plant.

Troy, Kans.—Voted to issue bonds for constructing an electric light plant.

Hartsells, Ala.—An electric light plant is contemplated. J. H. Corsble, mayor.

Manti, Utah.—This city voted to issue $25,000 bonds to construct an electric light plant.

Severy, Kans.—Will vote May 10 on the issue of bonds for building a municipal electric light plant.

Colby, Kans.—Bids are asked until May 3 for constructing an electric light plant. Fred A. Wertb, mayor.

Crawfordsville, Ind.—This city will vote May 17 on the construction of a new electric light and power plant.

Lebanon, Mo.—Voted to issue $20,000 bonds for improvements to the electric light plant. T. B. Bailey, cy. clk.

Ft. Logan H. Roots, Ark.—Bids are

asked until May 10 for constructing an electric light system here. Constr. Q. M.

Hoboken, N. J.—The Citizens' Light, Heat and Power Co. has asked for a franchise for lighting this city with electricity.

Hempstead, Tex.—An electric company has been organized to install an electric light plant. J. D. Harvey, prest.; J. C. Amsler, secy.

Newark, N. J.—An extension of the city hall lighting plant so as to supply electric light to municipal buildings near the city hall has been recommended.

Connersville, Ind.—The Connersville Light, Heat and Power Co. is preparing to ask for bids for enlarging and remodeling the plant.

Racine, Wis.—The question of improving the illumination of the streets of this city is being discussed. Mayor Horlick, Cy. Engr. Connolly.

Lockport, N. Y.—C. E. Dickinson heads a syndicate that bought out the Hydraulic Raceway Co. and will form a new company to bid for the lighting contract in this city.

Baltimore, Md.—Bids are asked until May 11 for furnishing and erecting electrical and mechanical equipment for the sewerage works. C. W. Hendricks, ch. engr. sewer comn.

Ft. Giebler, R. I.—Bids are asked until May 11 for the extension and remodeling of an underground electrical distributing system here. Lieut. Frank H. Phipps, Jr., constr. Q. M.

Laporte, Ind.—Julius A. Barner, A. L. Boyd, and J. J. Kreidler were appointed a committee by Mayor Darrow to consider the installation of boulevard lights in the down town districts.

Avon, N. Y.—A syndicate has purchased the entire capital stock of the Livonia Light and Heat Co., and will build a transmission line from there to this city and furnish electricity to both places.

New York City.—(Special). The Elmer P. Morris Company, manufacturers of lamps, posts and lighting specialties for exterior work, are erecting a factory at Elizabethtown, Pa. Upon its completion their present factory at Newark, N. J., is to be closed down. Although the new factory has a capacity of several times that of the old one, it will take several months to complete orders on hand.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Mankato, Minn.—Council contemplates the purchase of a sprinkling cart.

Paterson, N. J.—The question of cleaner streets is being agitated. Mayor McBride.

Corning, N. Y.—The construction of an incinerating plant is contemplated.

Rushville, Ind.—The advisability of oiling the paved streets is under consideration.

New Castle, Ind.—The business men and citizens have petitioned for the sprinkling of the streets.

Irvington, N. J.—The ordinance providing for the sprinkling of the streets with oil was laid over until May 3.

Oreton, Wis.—Bids are asked until May 5 for sprinkling the village streets. G. L. Booth, vil. clk.

Topeka, Kans.—The contract for constructing a crematory was awarded to Lewis & Kitchen, of Kansas City, Mo., for $16,700.

Vancouver, B. C.—Bids are asked until May 31 for installing a garbage destructor plant at Bridge st. W. McQueen, cy. clk.

Geneva, N. Y.—The contract for sprinkling and flushing the streets was awarded to Walter Curtis, at $115 a week for 30 weeks.

Newark, N. J.—The board of trade recommends that the streets be placed under the care of single commissioner, as one means of securing cleaner streets.

San Francisco, Cal.—The business men and residents of Kentucky st. are agitating the question of establishing a street sweeping and sprinkling service.

Boston, Mass.—Bids are asked until May 15 for furnishing watering carts and watering and oiling streets in 10 districts, and for cleaning streets and sidewalks in 4 districts. G. C. Emerson, supt. sts.

Washington, D. C.—Contracts were awarded April 7 for the collection and disposal of garbage, as follows. Collection and disposal of garbage, 5-year contract, to Washington Fertilizer Co., Washington, D. C., at $68,400 per year; collection and disposal of dead animals, 5-year contract, to Robt. E. Mann, Four Mile Run, Va., at $2,855 per year; collection and disposal of night-soil, 3-year contract, to Warner Stutler, Washington, at $16,600 per year; collection and disposal of miscellaneous refuse, weekly, 5-year contract, to Michael R. Ready, Washington, at $17,000 per year; collection and disposal of ashes, 5-year contract, to James W. Bean, Washington, at $73,150 per year; collection and disposal of ashes and refuse from buildings under control of the District Commissioners, 3-year contract, to Warner Stutler, Washington, at 40 cts. per cu. yd.

PARKS.

Bay City, Tex.—A 6-acre park tract adjoining the city limits is contemplated.

Memphis, Tenn.—The city park commissioners are working out plans for making the park system unsurpassed.

Glen Ridge, N. J.—Council passed a resolution to transfer Glen Park to the Essex County Park Commission.

Milwaukee, Wis.—The park commission will expend 68,000 on the improvement of the city's parks this year.

Pittsburg, Pa.—The civic commission has appointed Bion J. Arnold, of Chicago, John R. Freeman, of Providence, and Frederick Law Olmstead, of Boston, to plan extensive improvements to the park system here.

FIRE APPARATUS.

Sandpoint, Idaho.—Will vote June 7 on the issue of bonds for a fire alarm system.

Inkster, N. D.—The purchase of 2 chemical engines is contemplated at a cost of $700.

Beaumont, Tex.—The question of installing a fire alarm system is being considered.

Hackettstown, N. J.—The contract for furnishing 500 ft. of fire hose was awarded to the Voorhees Rubber Mfg. Co., of Jersey City, at 60 cts. a ft.

Portland, Ore.—Bids are asked until May 31 for furnishing 2 third-size fire eengines, 1 second hand fire engine and 2 combination chemical and hose wagons. Cy. audt.

Madison, N. J.—Bids for furnishing an auto-chemical fire engine were submitted April 11, as follows: Webb Motor Co., 1,000 ft. hose and hand extinguishers, $7,500; America-La France Co., machine, $6,500.